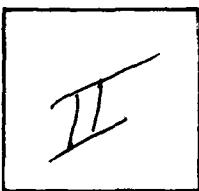


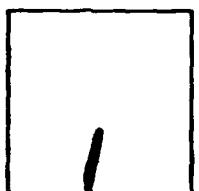
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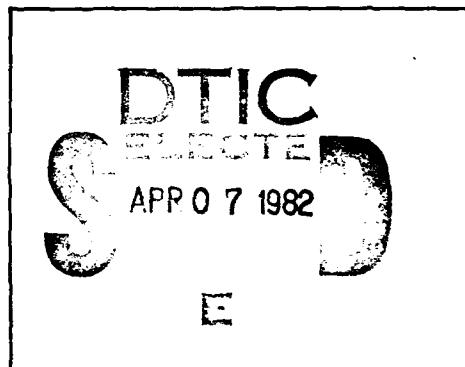
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GEOTECHNICAL INVESTIGATION
COMPACTED BACKFILL
BREAK-OUT AND ERECTION TRENCHES
MAV TEST SITE
SAN CRISTOBAL VALLEY, ARIZONA

Prepared For:

U. S. Department of the Air Force
Space and Missile Systems Organization (SAMSO)
Norton Air Force Base, California 92409

Prepared By:

Fugro National, Inc.
3777 Long Beach Boulevard
Long Beach, California 90807

23 October 1978

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents the results of our geotechnical investigation of the compacted & backfill material in the break-out and erosion demonstration trenches constructed at the M.A.V test site in San Cristobal Valley, Arizona.		

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1.0 INTRODUCTION AND SCOPE

This report presents the results of our geotechnical investigation of the compacted backfill material in the break-out and erection demonstration trenches constructed at the MAV Test Site in San Cristobal Valley, Arizona. The purpose of this investigation was to evaluate the engineering properties of the backfill material with particular emphasis on its moisture/density and strength characteristics. This study was performed for the Department of the Air Force, Space and Missile Systems Organization (SAMSO), in compliance with the conditions of the statement of work as part of contract No. F04704-77-C-0010.

This geotechnical investigation included:

- o drilling and sampling 24 test borings,
- o performing the requested series of laboratory tests,
- o analyzing the results of the field and laboratory programs,
and
- o the preparation of this report.

Preliminary laboratory test results were submitted to Captain B. Collins/MNNM on 31 July, 8 August, and 21 August 1978.

2.0 SITE DESCRIPTION

2.1 SITE LOCATION

The MAV Test Site is located in the northwest corner of San Cristobal Valley, Arizona (Figure 1) nearly halfway between Yuma (approximately 50 nm west) and Gila Bend (approximately 50 nm east). Interstate Highway 8 and the Southern Pacific Railroad are adjacent to the site on the north.

The location of the break-out and erection demonstration trenches is shown in Figure 2. These trenches lie approximately 1.5 miles (1.3 nm) west of Stoval Air Field and one mile (0.9 nm) south of Interstate Highway 8.

2.2 GENERAL SITE AND SUBSURFACE CONDITIONS

A detailed description of the general site and subsurface conditions is presented in the Fugro National report FN-TR-14, titled "MX Siting Investigation, Geotechnical Evaluation, Multiple Aim-Point Validation (MAV) Program, Luke Bombing and Gunnery Range, Arizona", dated 30 September 1976.

Since the date of the above study, numerous facilities have been constructed at the MAV Test Site as part of an evaluation of the MX buried trench basing mode concept. These new facilities include various support facilities for the construction of the 20,000 foot (6.1 km) long trench as well as the break-out and erection demonstration trenches.

2.3 BREAK-OUT AND ERECTION DEMONSTRATION TRENCHES

These demonstration trenches have been constructed to evaluate the performance of the MX missile pre-launch break-out and erection mechanisms developed by the Boeing Company and the Martin Marietta Company. Three trench sections have been constructed; one each for the Boeing gas system, the Boeing hydraulic system, and the Martin Marietta gas system. Each trench contains a precast concrete pipe which simulates the actual buried trench protective structure.

Typical cross sections for the Boeing and Martin Marietta trenches are shown in Figure 3. The trench at both sites is 20 feet (6 m) wide at its base and has side slopes of 3/4:1 (horizontal: vertical). The Martin Marietta trench walls are benched. In both sections, the precast concrete pipe has an outside diameter of 15.67 feet (4.8 m) and rests on sand-cement bedding material. Compacted backfill was placed around and over the pipe, completely filling the trench.

Fugro personnel were not present during the construction of these trenches. We understand that the material excavated from the trenches was used for backfill. Apparently, this material was excavated, stockpiled, replaced, and compacted to a minimum dry density of 80 percent of ASTM D-1557, Method A.

3.0 FIELD PROGRAM

The field program performed as part of this investigation consisted of drilling and sampling 24 test borings at the locations shown in Figures 3 and 4. All borings at the Boeing gas and hydraulic sites and three borings at the Martin Marietta gas site were completed during the period of 17 July to 20 July 1978. The remaining seven borings at the Martin Marietta gas site were drilled and sampled on 17 August 1978.

As shown in Figure 3, the test borings above the crown of the concrete pipe were approximately five feet (1.5 m) deep, while the borings beyond the edge of the pipe were about ten feet (3 m) deep. Drilling was accomplished using the rotary-air technique. Continuous sampling was accomplished using primarily the Shelby

tube sampling technique. However, a few samples were also obtained using Pitcher barrel and Fugro drive samplers. All test borings were logged during the drilling and sampling operation and the resulting boring logs are presented in Tables 1, 2, and 3.

The backfill samples were sealed in the field and transported to our laboratory in Long Beach, California for testing.

4.0 LABORATORY PROGRAM

The laboratory testing program consisted of performing moisture/density, grain size analyses, Atterberg Limits, specific gravity, and consolidated-drained triaxial compression tests. The number of tests performed in this laboratory program is summarized below.

<u>Laboratory Test</u>	<u>Number of Tests</u>
Moisture/Density	224
Grain Size Analysis	24
Atterberg Limits	21
Specific Gravity	3
Consolidated-Drained Triaxial Compression	60

The moisture/density tests were performed on samples at a maximum depth interval of one foot (0.3 m). Samples for consolidated-drained triaxial compression testing were selected in accordance with the instructions received from Captain B. Collins/MNNM. These triaxial compression tests were conducted using isotropic confining pressures of 0.7, 2.9 and 5.8 ksf (33.5, 138.9 and

277.7 kN/m²). A moisture/density test was performed on each tri-axial compression test specimen. Representative grain size analysis and Atterberg Limits tests were performed on selected samples to confirm their field classification.

The results of the moisture/density, grain size analysis, Atterberg Limits, and specific gravity tests are summarized in Tables 4, 5, and 6. The results of the consolidated-drained tri-axial compression tests are presented in Figures 6, 7, and 8 and Tables 7, 8, and 9.

5.0 RESULTS

As shown in the boring logs, the backfill material encountered in the test borings consisted of brown, firm to stiff sandy clay (CL), and medium dense to dense, fine- to medium-grained clayey sand (SC). These soils contained occasional gypsum and caliche fragments as well as fine gravel. The range in gradation of the backfill material is shown in Figure 5. Considerable variation in both the moisture content and consistency of the backfill material was observed during the drilling and sampling program.

The dry density of the soil samples tested ranged from 90.0 to 119.2pcf (1440 to 1907 kg/m³) and the moisture content ranged from 5.4 to 20.3 percent. Differences were observed between the dry densities and moisture contents for the three test sites, as shown on the following table.

<u>Test Site</u>	<u>Dry Density pcf (kg/m^3)</u>	<u>Moisture Content percent</u>
Boeing Gas	93.3 - 113.5 (1493 - 1816)	7.8 - 16.3
Boeing Hydraulic	90.0 - 117.9 (1440 - 1886)	8.6 - 20.3
Martin Marietta Gas	91.4 - 119.2 (1462 - 1907)	5.4 - 16.3

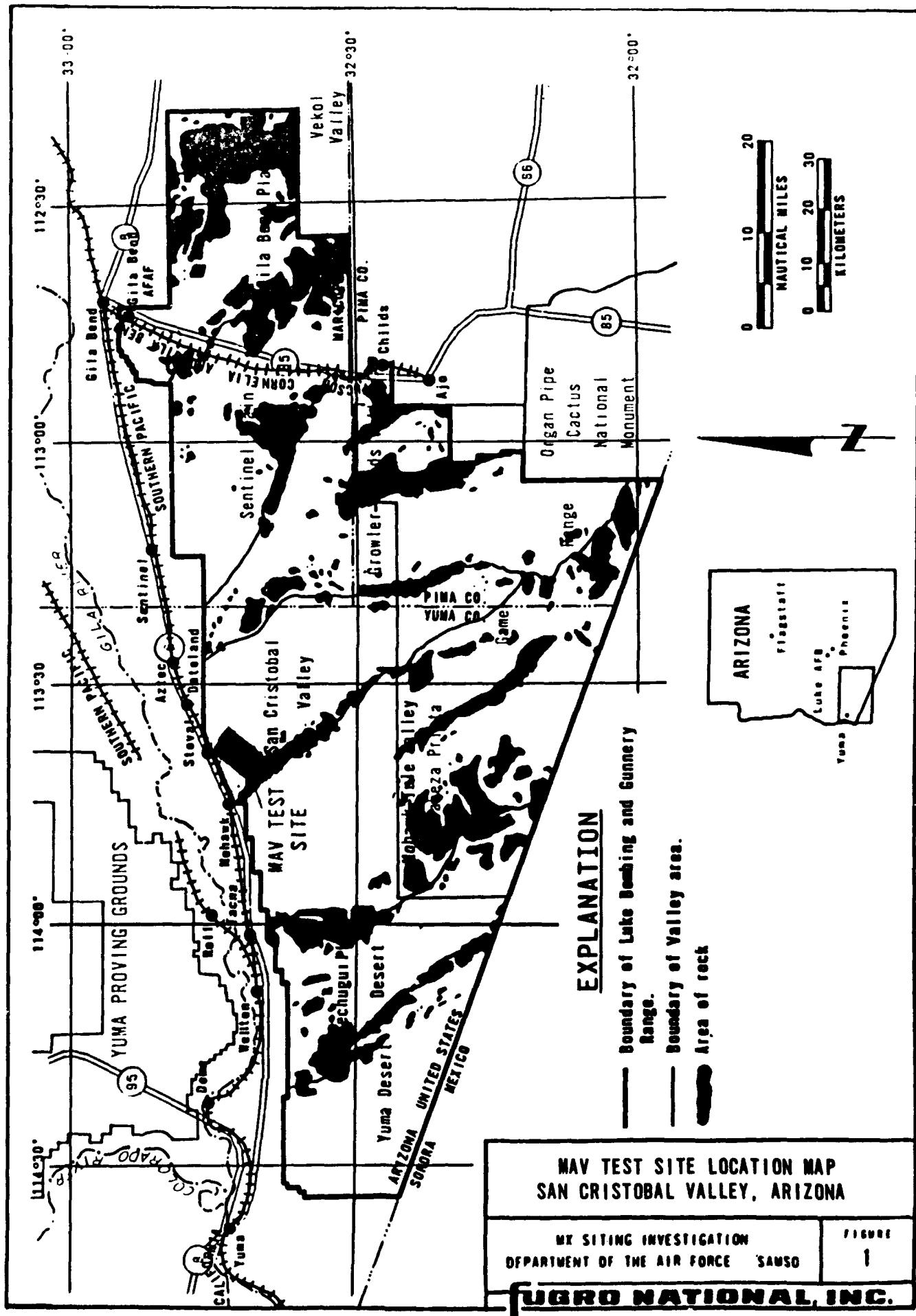
The results of the consolidated-drained triaxial compression tests were used to evaluate the strength characteristics of the backfill material. Figures 6, 7, and 8 present the Mohr's circles for these triaxial compression tests. The results of these tests are also summarized in the p-q diagrams presented in Figures 9, 10, and 11 for the Boeing gas, Boeing hydraulic, and Martin Marietta gas sites, respectively. Each p-q diagram plots the quantity $\frac{\sigma_1 - \sigma_3}{2}$ on the ordinate and the quantity $\frac{\sigma_1 + \sigma_3}{2}$ on the abscissa, where σ_1 is the major principle stress at failure and σ_3 is the minor principle stress (sample confining pressure). A p-q diagram has the characteristic that a straight-line fit through the data points will have a slope of $\sin(\phi)$ and an intercept of $c \cos(\phi)$ where c and ϕ are the soil cohesion and angle of internal friction, respectively.

Using the method of least-squares, such a straight-line fit was made to the test data for each of the sites, and the following average values for c and ϕ were obtained.

<u>Test Site</u>	<u>Cohesion, c ksf (kN/m^2)</u>	<u>Friction Angle, ϕ degrees</u>
Boeing Gas	1.4 (67.1)	28
Boeing Hydraulic	1.7 (81.4)	28
Martin Marietta Gas	1.4 (67.1)	31

The above average values for c and ϕ fall in a fairly narrow range. However, as shown by the Mohr's circles plotted in Figures 6, 7, and 8, relatively large variations in c and ϕ were observed between individual sets of test results.

As part of this investigation, attempts were made to develop correlations between the cohesion and angle of internal friction of the backfill material and such parameters as dry density, moisture content, gradation, and Atterberg Limits. Based on our analyses, no significant correlations were apparent.

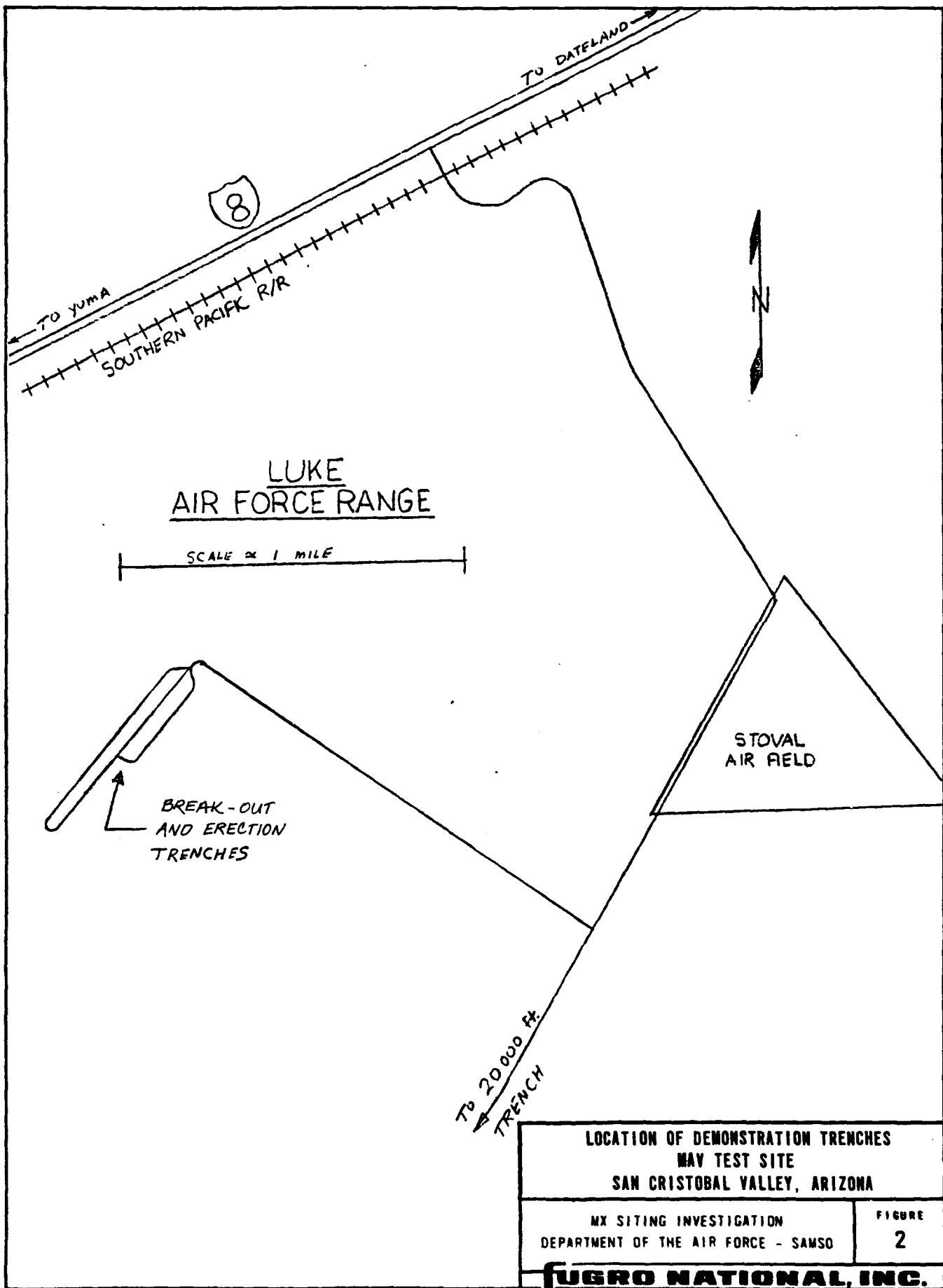


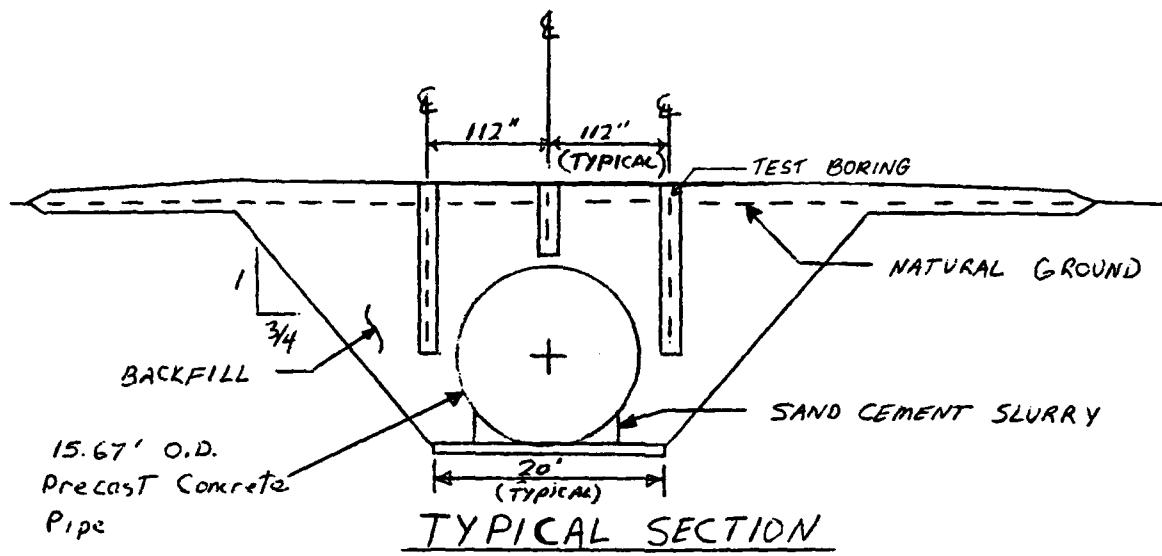
**MAV TEST SITE LOCATION MAP
SAN CRISTOBAL VALLEY, ARIZONA**

MX SIGHTING INVESTIGATION
DEPARTMENT OF THE AIR FORCE 'SAMSON'

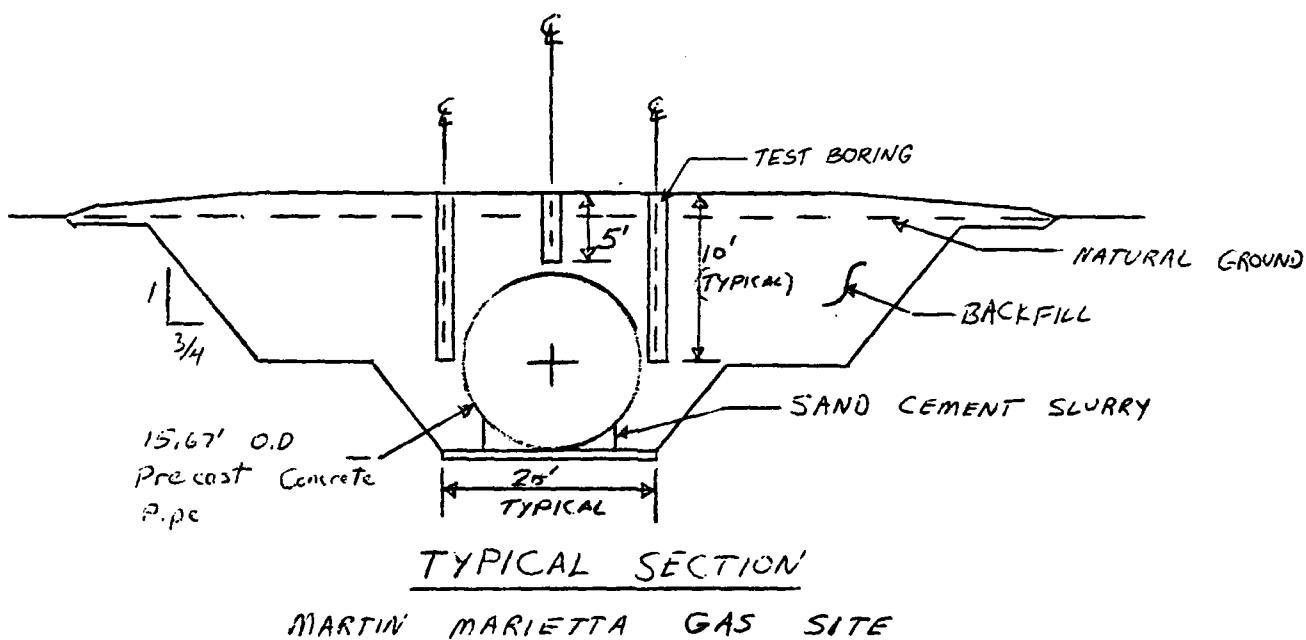
FIGURE
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BOEING HYDRAULIC AND GAS SITES



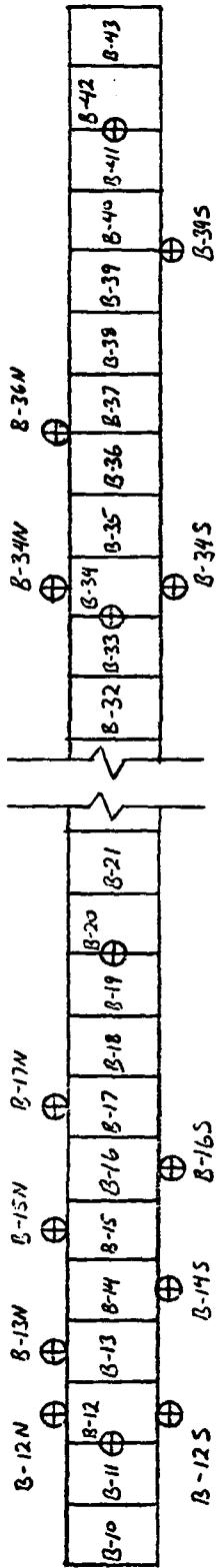
TYPICAL TRENCH SECTIONS
MAV TEST SITE
SAN CRISTOBAL VALLEY, ARIZONA

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DEPARTMENT OF THE AIR FORCE - SAMSO

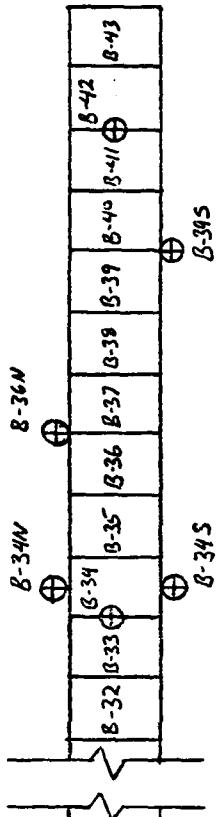
FIGURE
3

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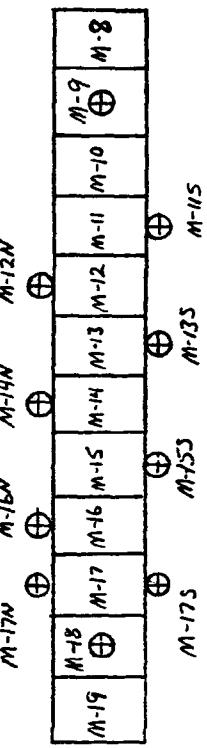
BOEING GAS SITE



BOEING HYDRAULIC SITE



MARTIN MARIETTA GAS SITE

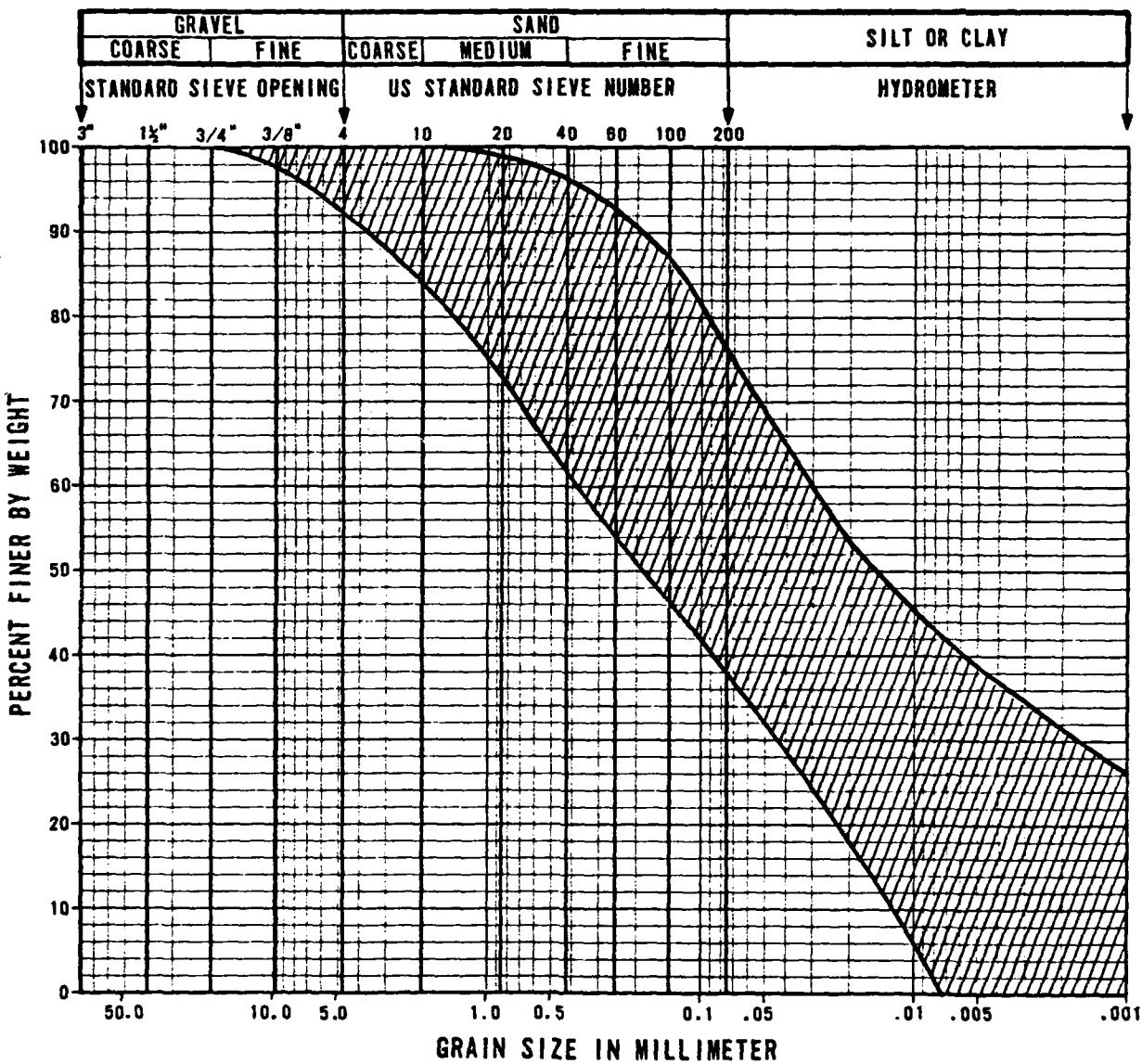


SCALE: 1" = 30'

EXPLANATION

⊕ TEST BORING LOCATION

LOCATION OF TEST BORINGS MAY TEST SITE SAN CRISTOBAL VALLEY, ARIZONA		FIGURE
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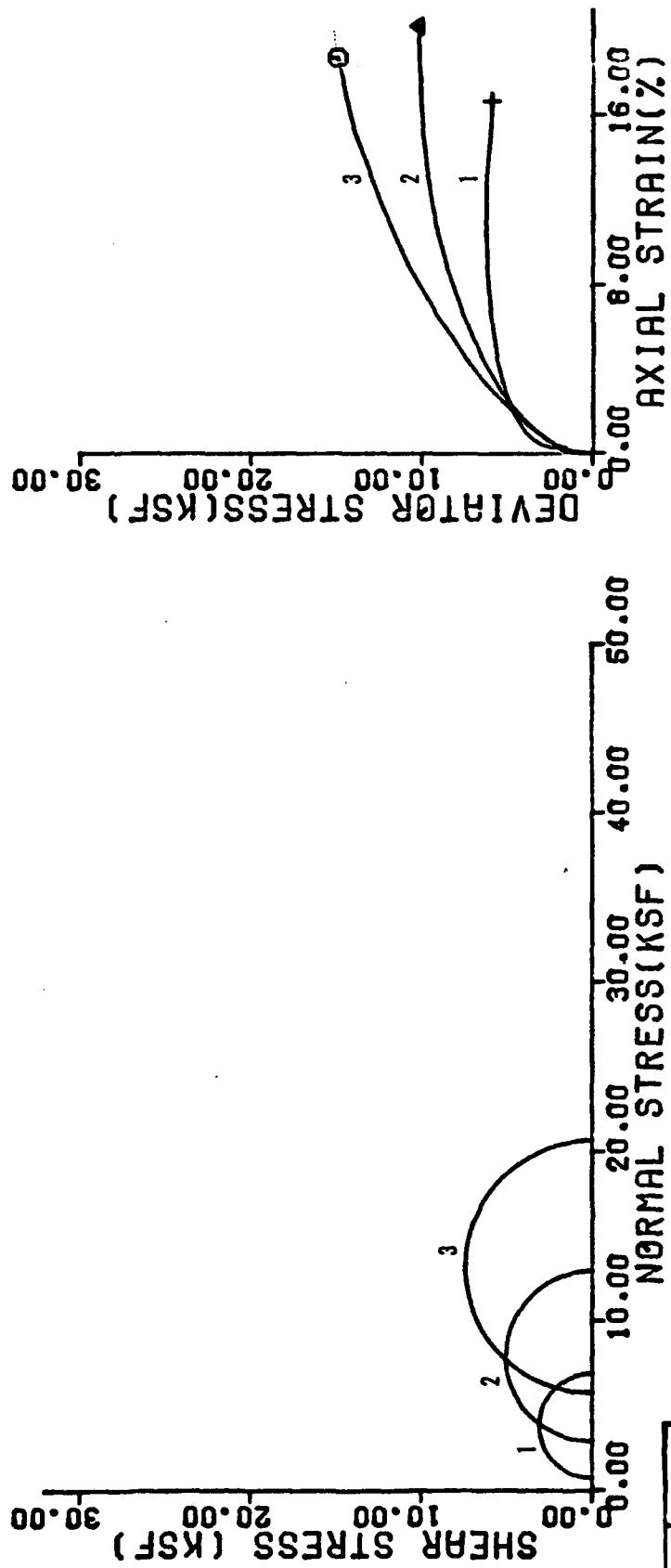


RANGE IN GRADATION OF BACKFILL MATERIAL
MAY TEST SITE
SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
5

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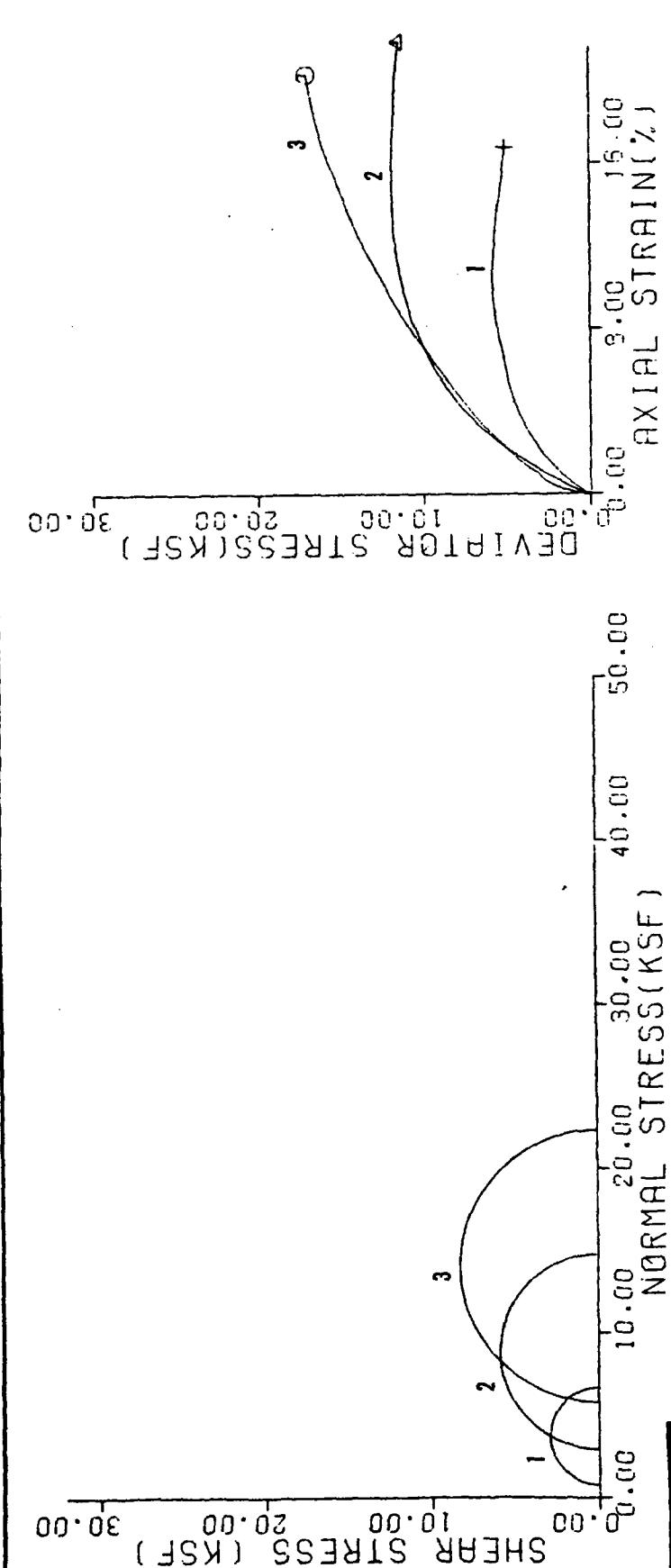


SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		CONFINING PRESSURE (σ_3)	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$)
			FEET	METERS	kst	kN/m ²
1	B-11	S-1-2	1.1-1.8	0.34-0.55	0.7	33.5
2	B-11	S-1-3	1.8-2.5	0.55-0.76	2.9	138.9
3	B-11	S-2-2	3.8-4.3	1.10-1.52	5.8	277.7
					14.9	713

TRIAXIAL COMPRESSION TESTS
BOEING GAS SITE
NAV TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
6
1 OF 7

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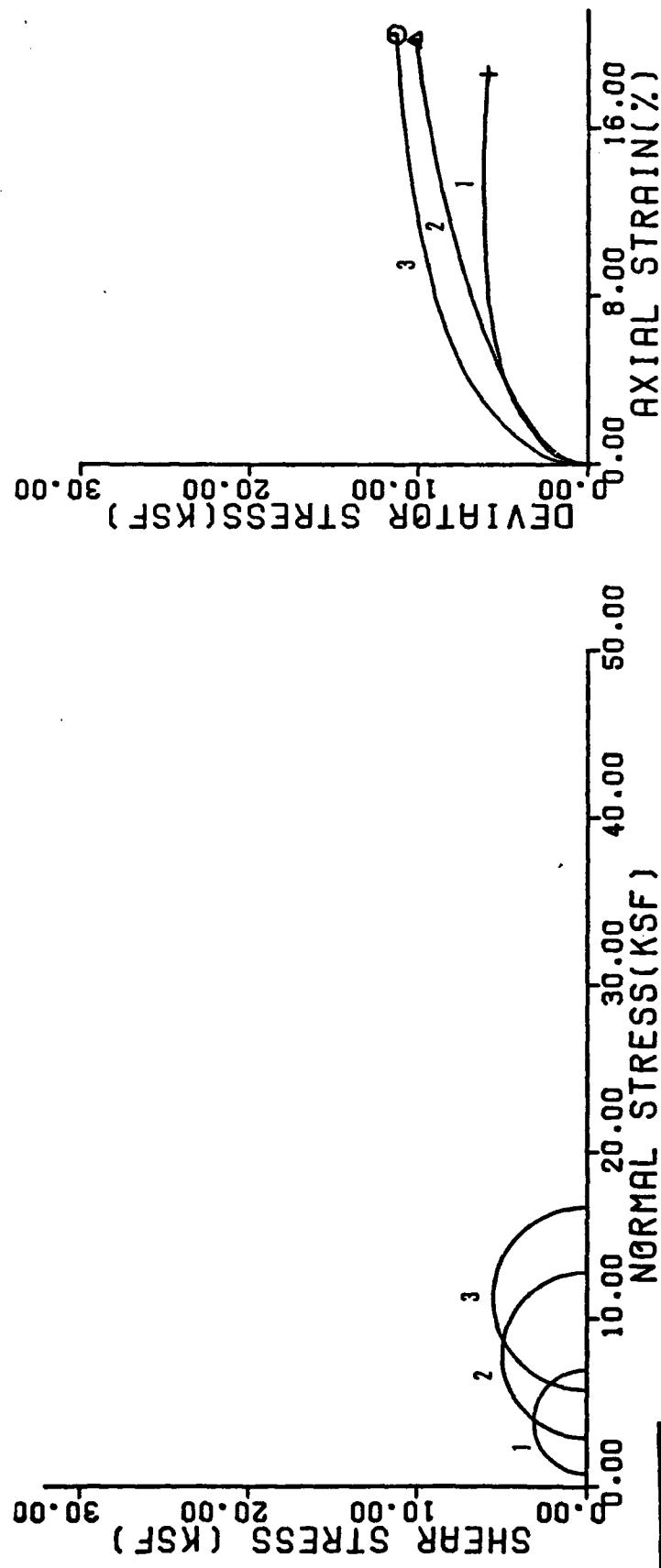
SYMBOL NO.	BORING SAMPLE NO.	SAMPLE INTERVAL FEET	SAMPLE INTERVAL METERS	CONFINING PRESSURE (σ_3)		MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$)
				ksf	kN/m ²	
1	B-12N	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5
2	B-12N	S-3-1	5.0-5.7	1.52-1.74	2.9	138.9
3	B-12N	S-3-2	5.7-6.4	1.74-1.95	5.8	277.7

TRIAXIAL COMPRESSION TESTS
BOEING GAS SITE
MAV TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

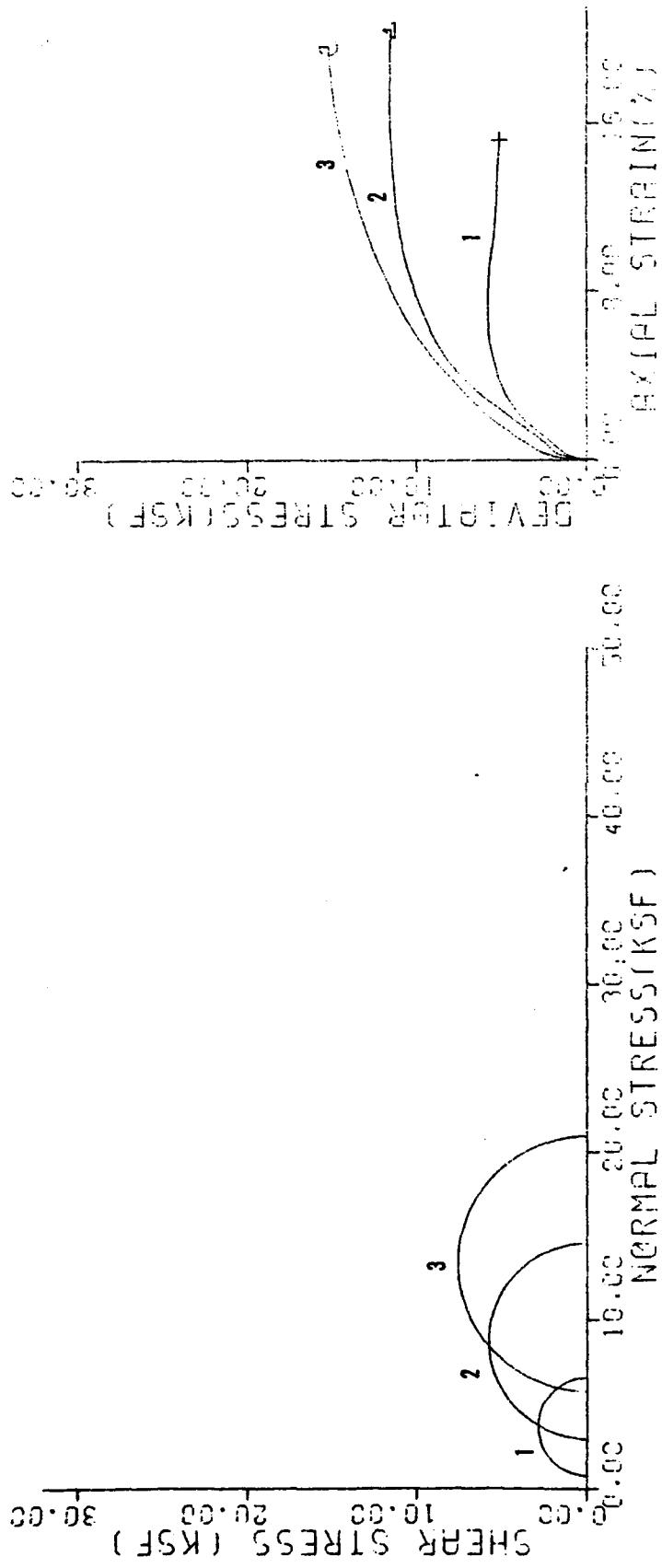
FIGURE
6
2 OF 7

FUGRO NATIONAL, INC.



SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL FEET	CONFINING PRESSURE (σ_3) METERS	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$)	
					kN/m ²	kN/m ²
1	B-12S	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5
2	B-12S	S-3-1	5.0-5.7	1.52-1.74	2.9	138.9
3	B-12S	S-3-2	5.7-6.4	1.74-1.95	5.8	277.7

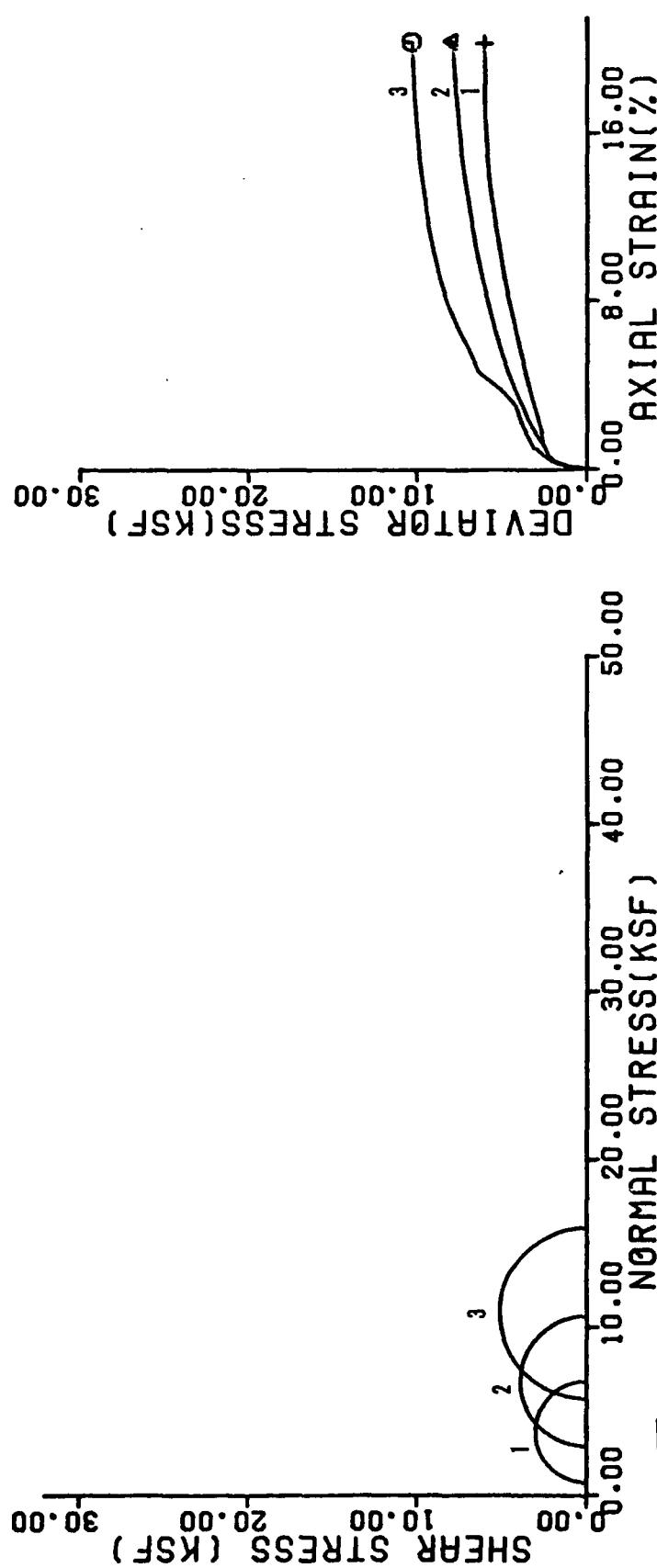
TRIAXIAL COMPRESSION TESTS BOEING GAS SITE MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO	
FIGURE 6 3 OF 7	FUGRO NATIONAL, INC.



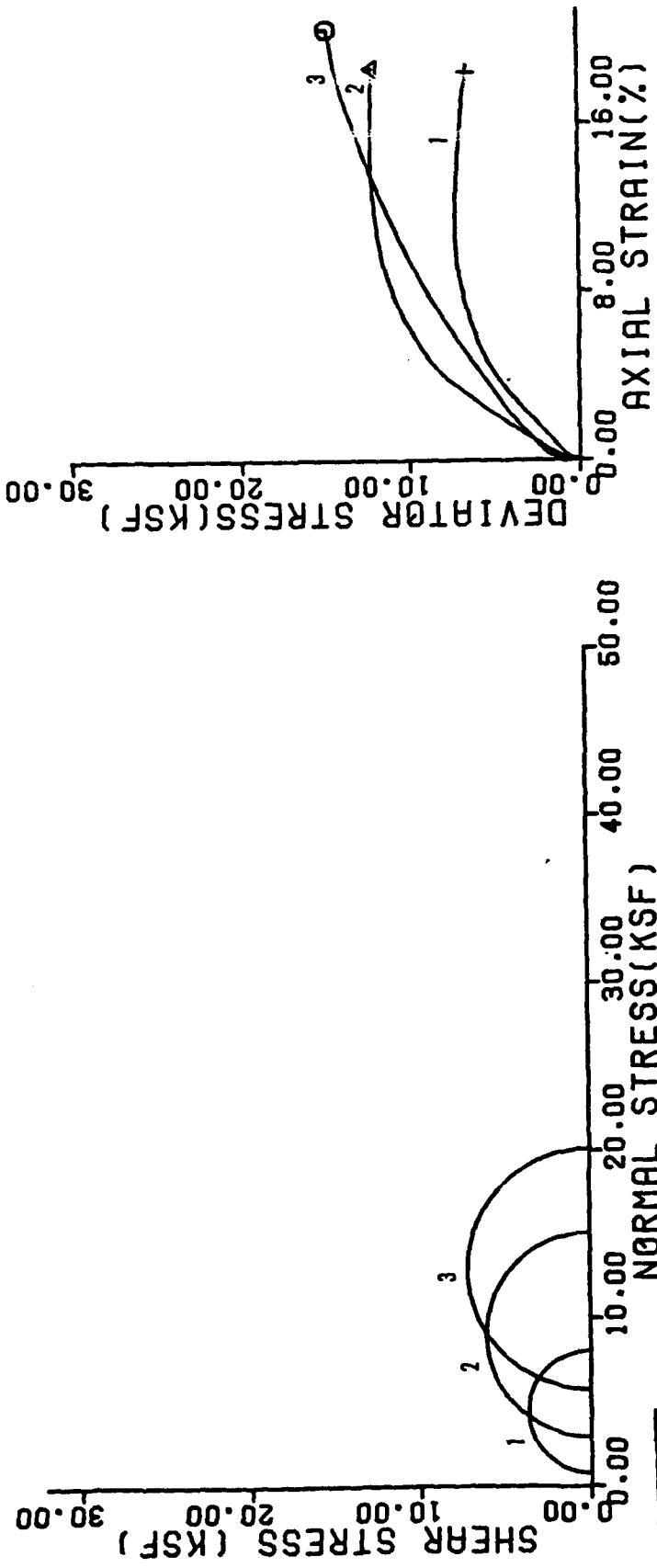
SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL FEET	SAMPLE INTERVAL METERS	CONFINING PRESSURE (σ_3)	MAXIMUM DEVATOR STRESS ($\sigma_1 - \sigma_3$)
1	B-13N	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5 ksf 278 kn/m ²
2	B-13N	S-3-1	5.0-5.7	1.52-1.74	2.8	138.9 ksf 11.6 555 kn/m ²
3	B-13N	S-3-2	5.7-6.4	1.74-1.95	5.8	277.7 ksf 15.2 728 kn/m ²

TRIAXIAL COMPRESSION TESTS BOEING GAS SITE MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO	FIGURE 6 4 OF 7

FUGRO NATIONAL, INC.



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL FEET	SAMPLE INTERVAL METERS	CONFINING PRESSURE (σ_3) ksf	CONFINING PRESSURE (σ_3) kN/m ²	MAXIMUM DEVIATOR STRESS (σ_d) ksf	MAXIMUM DEVIATOR STRESS (σ_d) kN/m ²
1	B-14S	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5	6.0	287
2	B-14S	S-3-1	5.1-5.8	1.55-1.77	2.8	138.9	7.8	373
3	B-14S	S-3-2	5.8-6.5	1.77-1.98	5.8	277.7	10.2	488



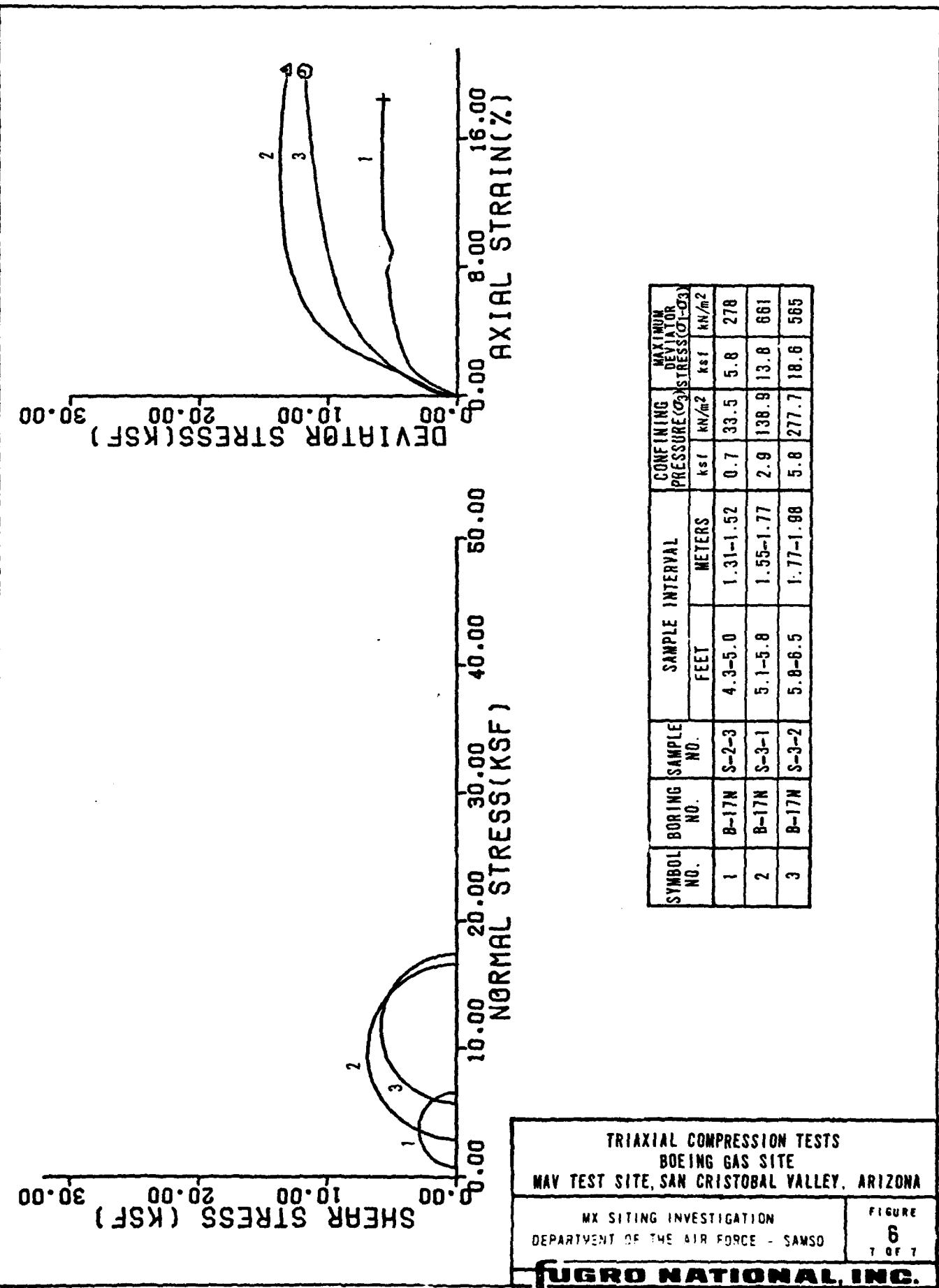
SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		CONFINING PRESSURE (σ_3)	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$)
			FEET	METERS		
1	B-15N	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5
2	B-15N	S-3-1	5.0-5.7	1.52-1.74	2.9	138.9
3	B-15N	S-3-2	5.7-6.4	1.74-1.95	5.8	277.7

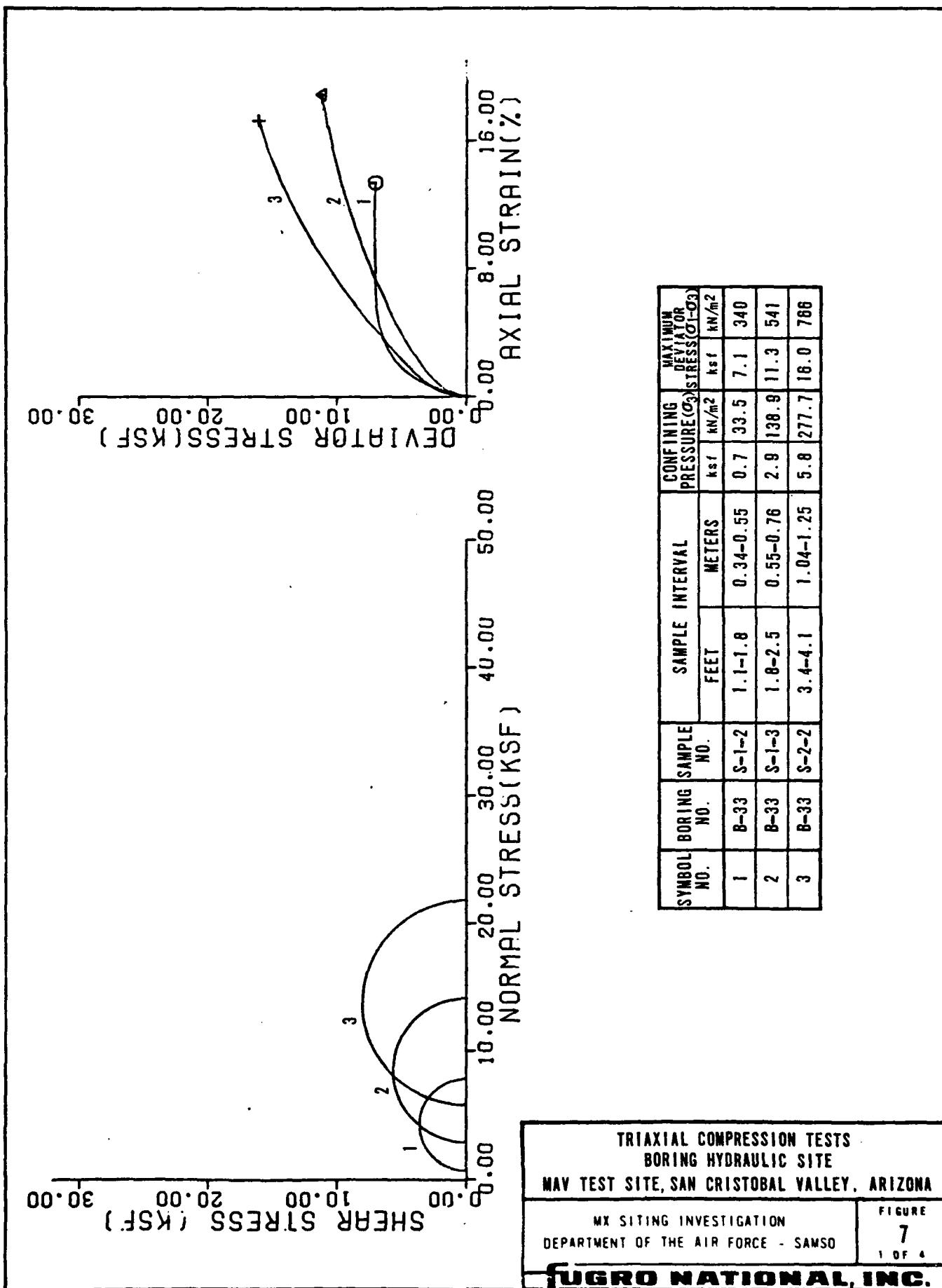
TRIAXIAL COMPRESSION TESTS
BOEING GAS SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

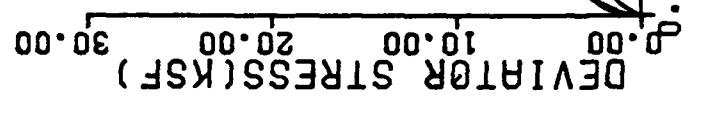
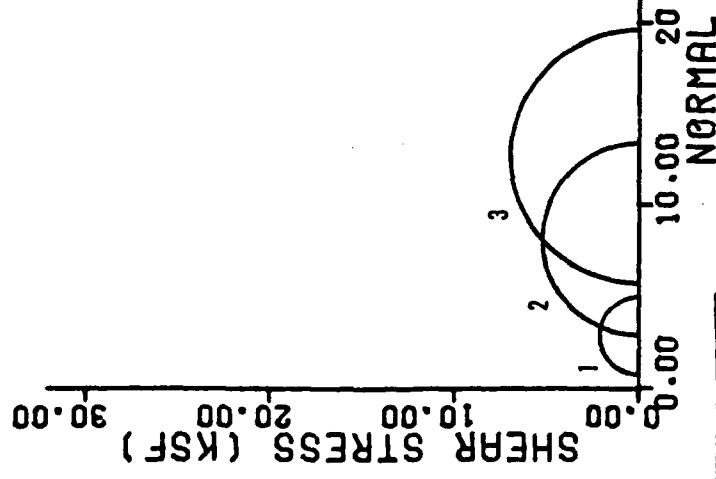
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FIGURE
6
6 OF 7

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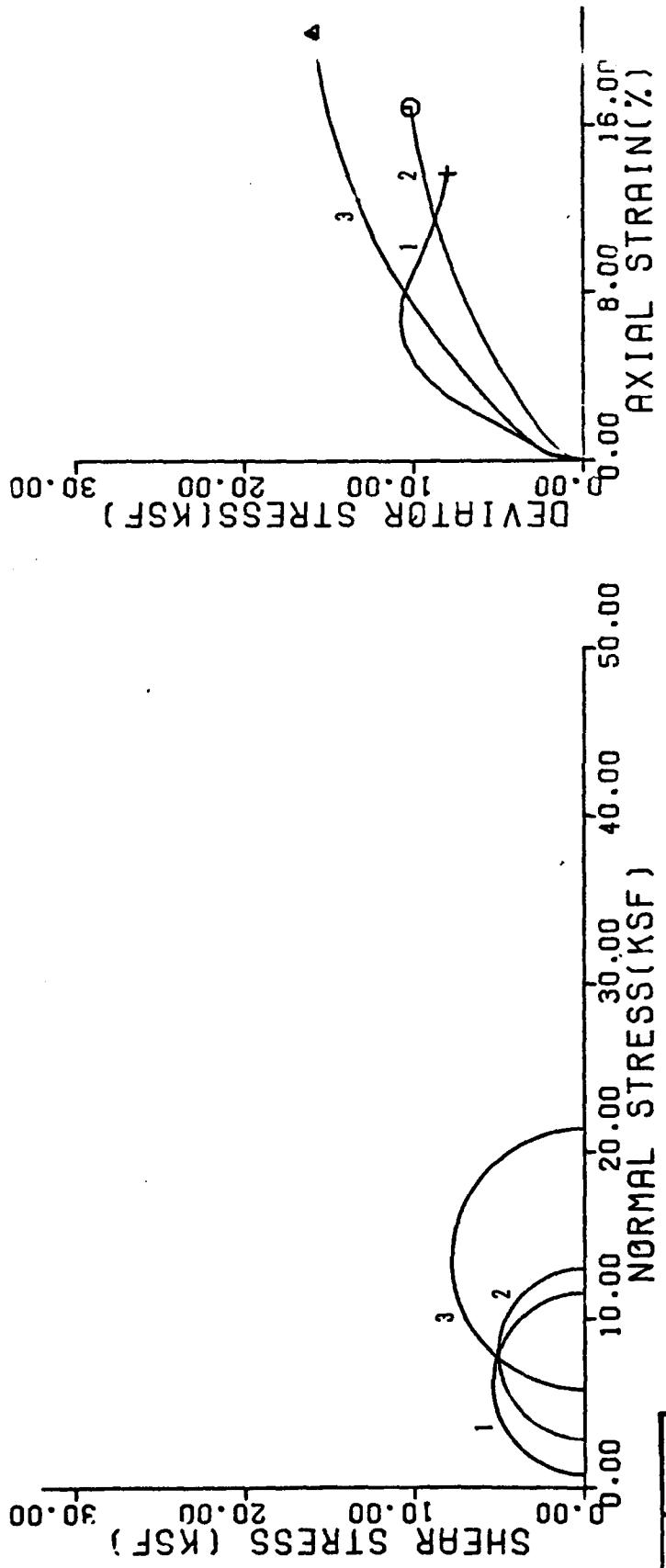




SYMBOL BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		MAXIMUM CONFINING PRESSURE (σ_3) KSF	MAXIMUM DEVIAVATOR STRESS ($\sigma_1 - \sigma_3$) KSF
		FEET	METERS		
1	B-34N	P-3-3	4.8-5.2	1.46-1.68	0.7 33.5 4.3 206
2	B-34N	S-4-1	5.7-8.4	1.74-1.95	2.9 138.9 10.6 508
3	B-34N	S-4-2	6.4-7.1	1.95-2.16	5.8 277.7 13.9 670

TRIAXIAL COMPRESSION TESTS BOEING HYDRAULIC SITE MAV TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO	FIGURE 7 2 OF 4

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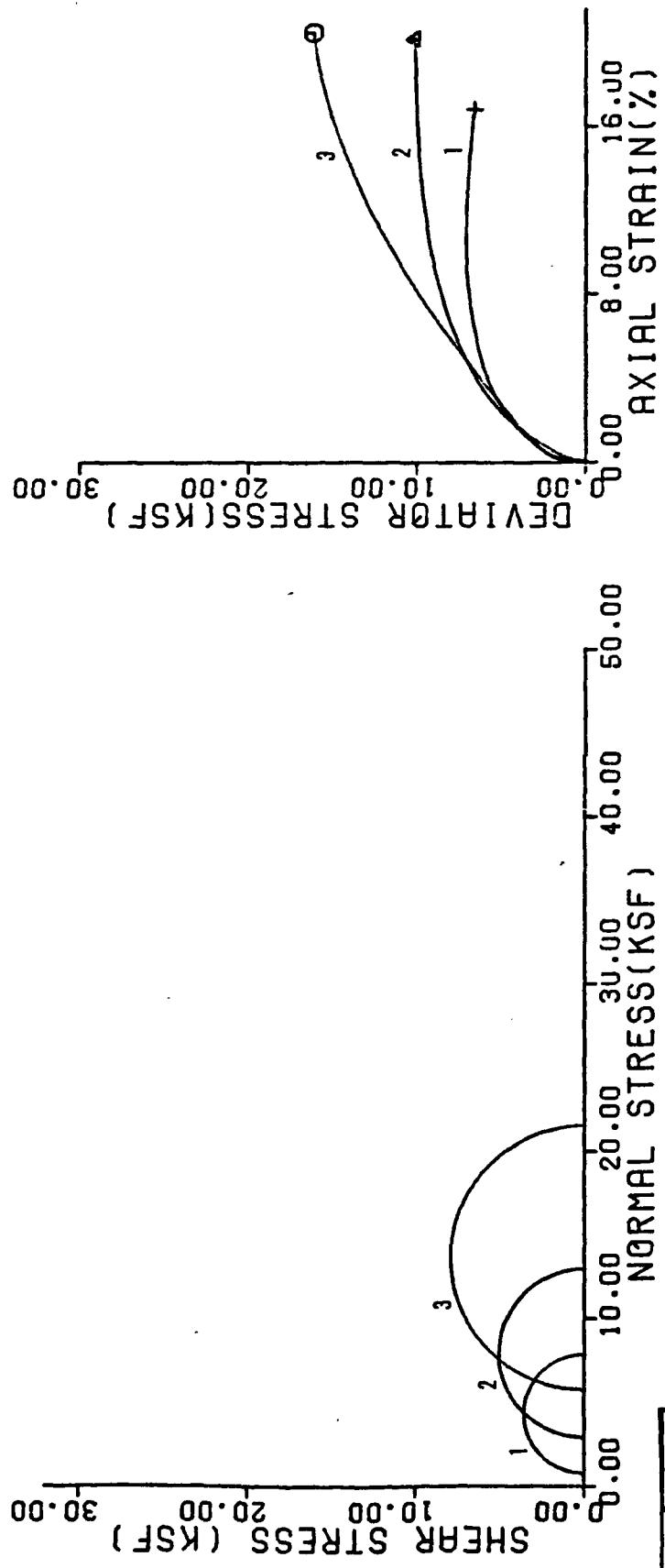


SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL FEET	SAMPLE INTERVAL METERS	CONFINING PRESSURE(σ_3) ksf	CONFINING PRESSURE(σ_3) kN/m ²	MAXIMUM DEVIATOR STRESS($\sigma_1 - \sigma_3$) ksf	MAXIMUM DEVIATOR STRESS($\sigma_1 - \sigma_3$) kN/m ²
1	B-34S	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5	10.8	517
2	B-34S	S-3-2	5.8-6.5	1.77-1.98	2.9	136.9	10.1	484
3	B-34S	S-3-3	6.5-7.5	1.98-2.28	5.8	277.7	15.6	747

TRIAXIAL COMPRESSION TESTS
BOEING HYDRAULIC SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
7
3 OF 4

FUGRO NATIONAL, INC.

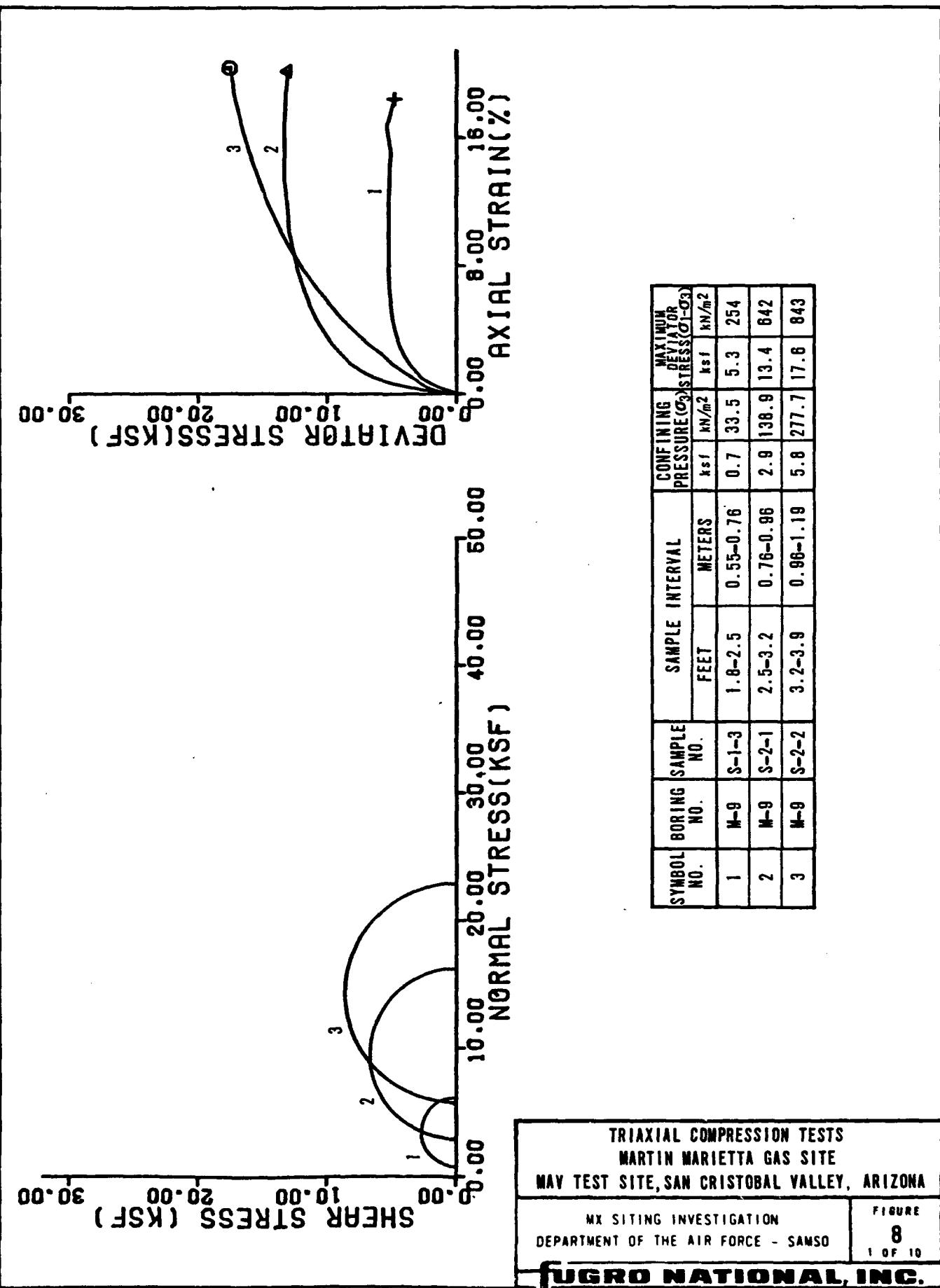


SYMBOL BORING NO.	BORING SAMPLE NO.	SAMPLE INTERVAL FEET	SAMPLE INTERVAL METERS	CONFINING PRESSURE (σ_3) ksf	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$) kN/m ²	
1	B-36N	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5
2	B-36N	S-3-1	5.1-5.8	1.55-1.77	2.9	138.9
3	B-36N	S-3-2	5.8-6.5	1.77-1.98	5.8	277.7

TRIAXIAL COMPRESSION TESTS
 BOEING HYDRAULIC SITE
 MAV TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA
 MX SITING INVESTIGATION
 DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
 7
 4 OF 4

FUGRO NATIONAL, INC.



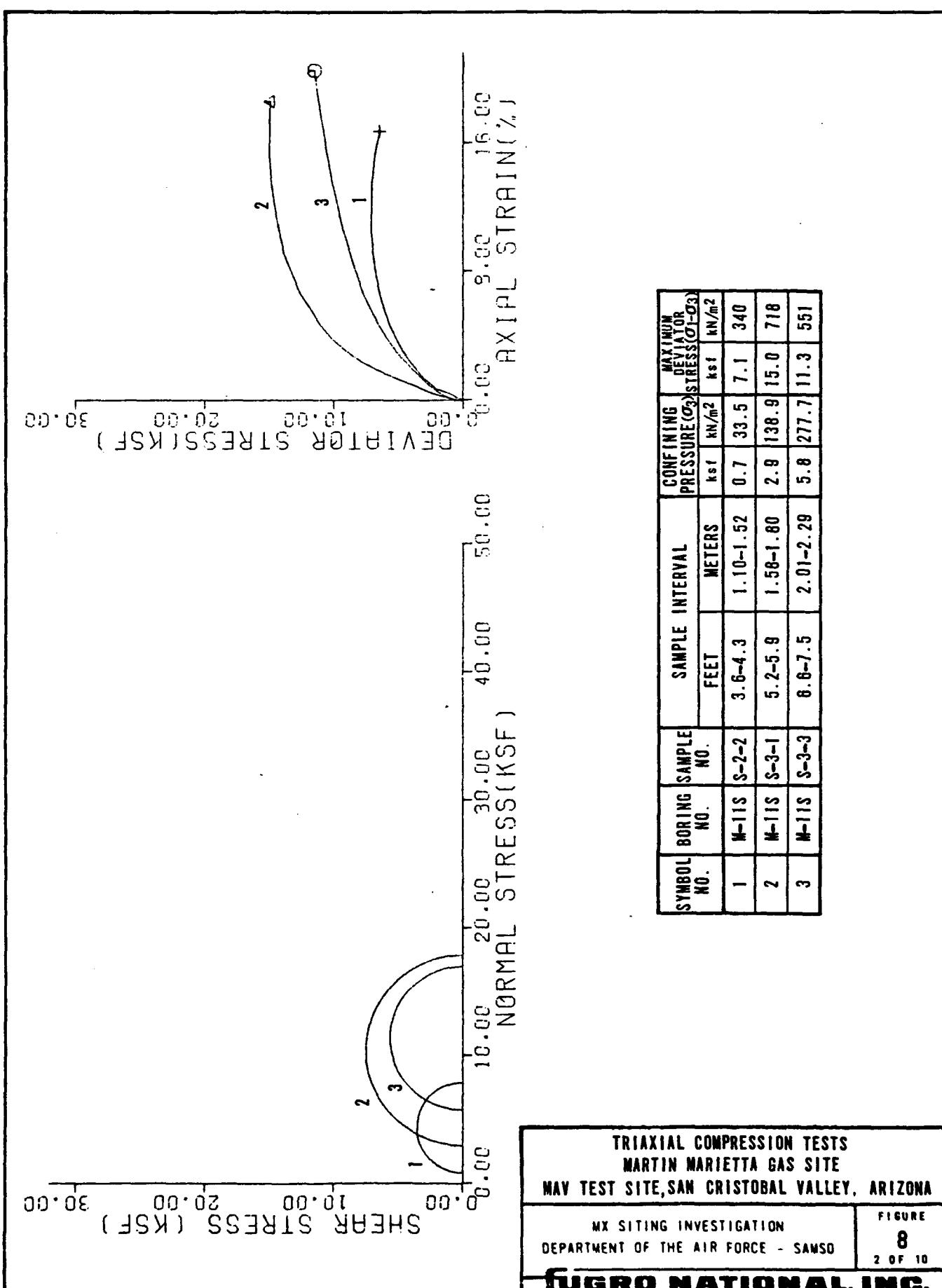
SYMBOL BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		CONFINING PRESSURE (σ_3) STRESS ($\sigma_1 - \sigma_3$)	MAXIMUM DEPRESS. kN/m ²			
		FEET	METERS					
1	M-9	S-1-3	1.8-2.5	0.55-0.76	0.7	33.5	5.3	254
2	M-9	S-2-1	2.5-3.2	0.76-0.96	2.9	138.9	13.4	642
3	M-9	S-2-2	3.2-3.9	0.96-1.19	5.8	277.7	17.6	843

TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSON

FIGURE
8
1 OF 10

FUGRO NATIONAL, INC.

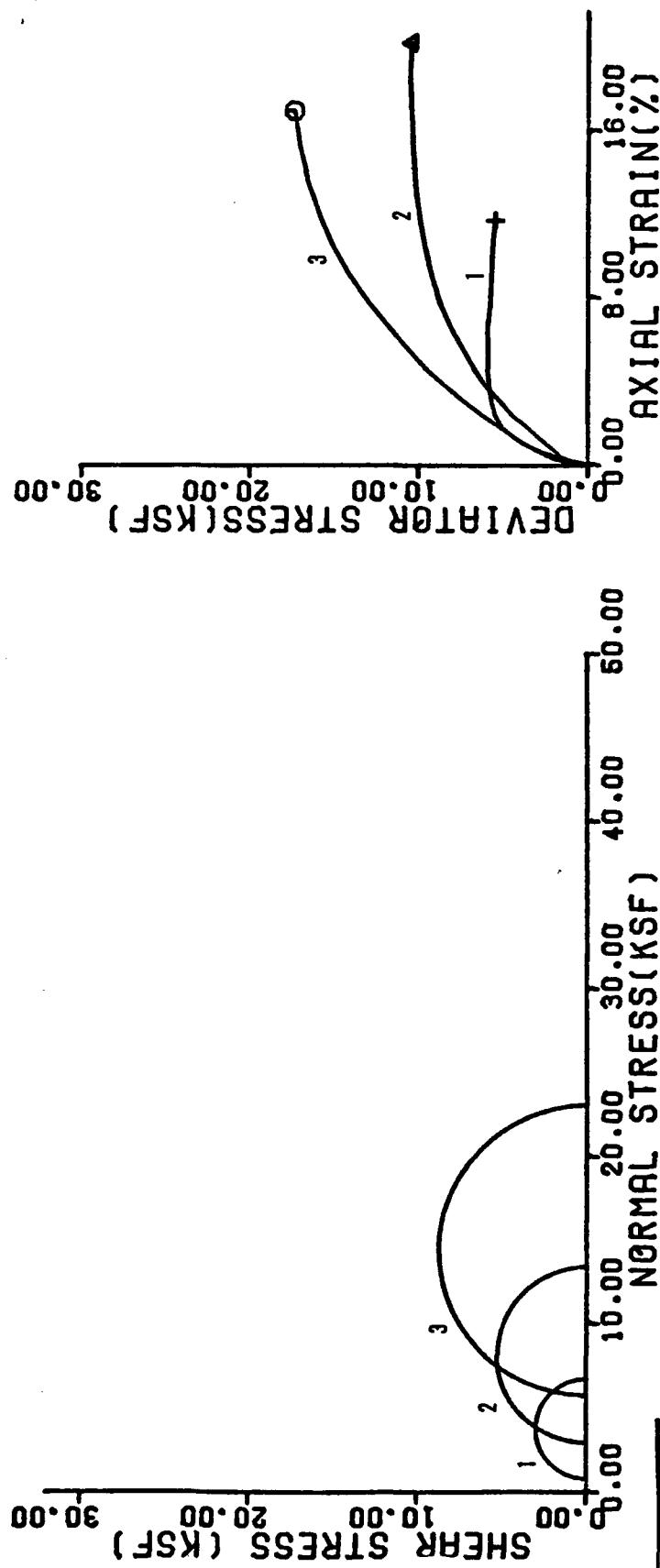


TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
8
2 OF 10

FUGRO NATIONAL, INC.



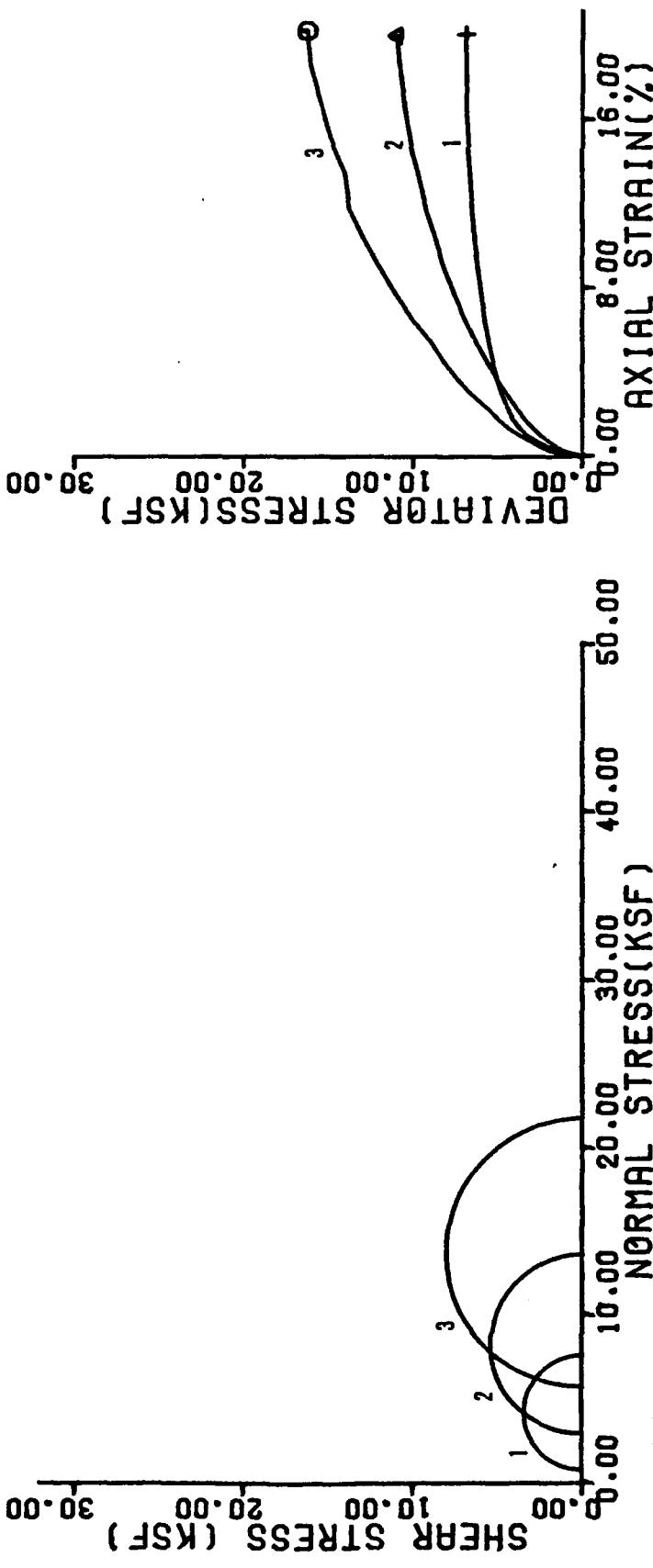
SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		CONFINING PRESSURE(σ_3) kN/m ²	MAXIMUM DEVATOR STRESS($\sigma_1 - \sigma_3$) kN/m ²
			FEET	METERS		
1	M-12N	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5
2	M-12N	S-3-1	5.0-5.7	1.52-1.74	2.9	136.9
3	M-12N	S-3-2	5.7-6.4	1.74-1.95	5.8	277.7

TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
8
3 OF 10

FUGRO NATIONAL, INC.



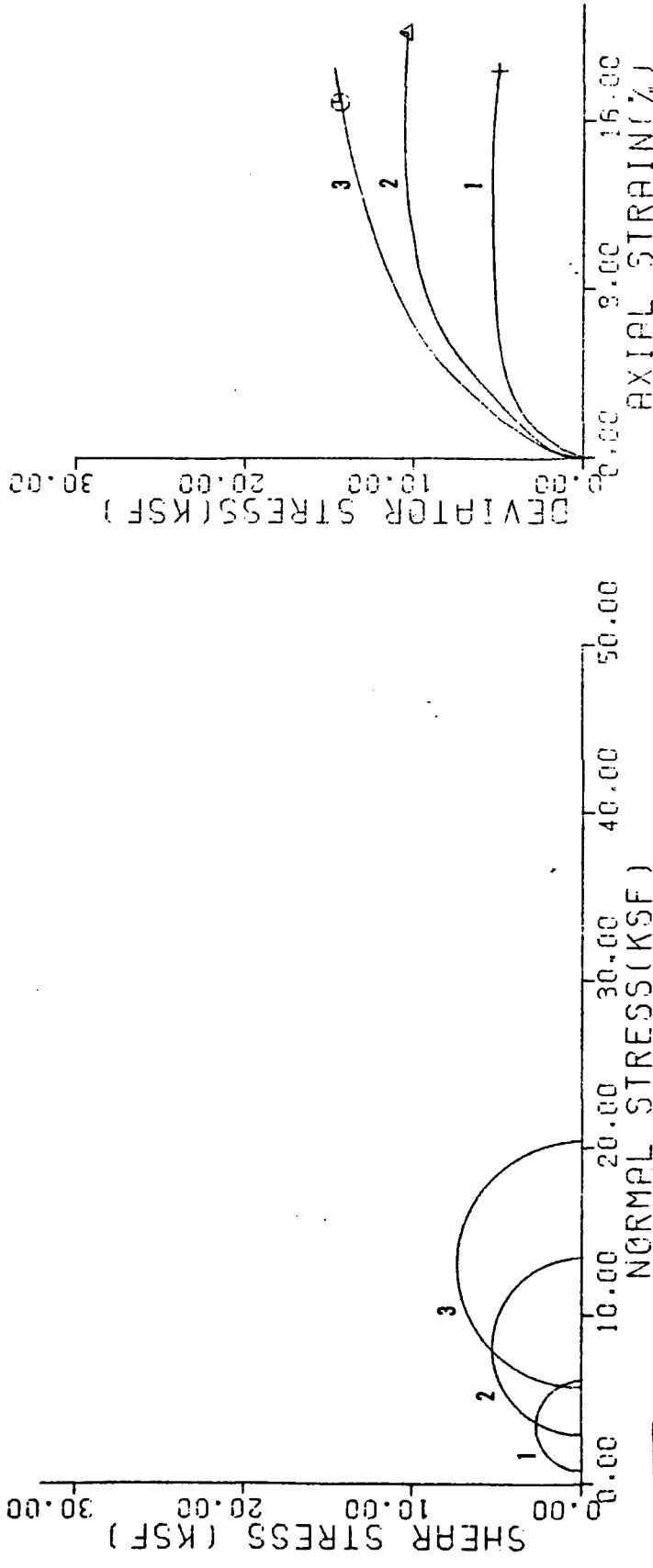
SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL FEET	CONFINING PRESSURE (COP) STRESS (K-03)
			METERS	KSI KN/m ² kN/m ²
1	H-13S	S-2-3	4.3-5.0	1.31-1.52 0.7 33.5 6.9 330
2	H-13S	S-3-1	5.0-5.7	1.52-1.74 2.9 138.9 11.0 527
3	H-13S	S-3-2	5.7-6.4	1.74-1.95 5.8 277.7 16.3 780

TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
NAV TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
8
4 OF 10

FUGRO NATIONAL, INC.



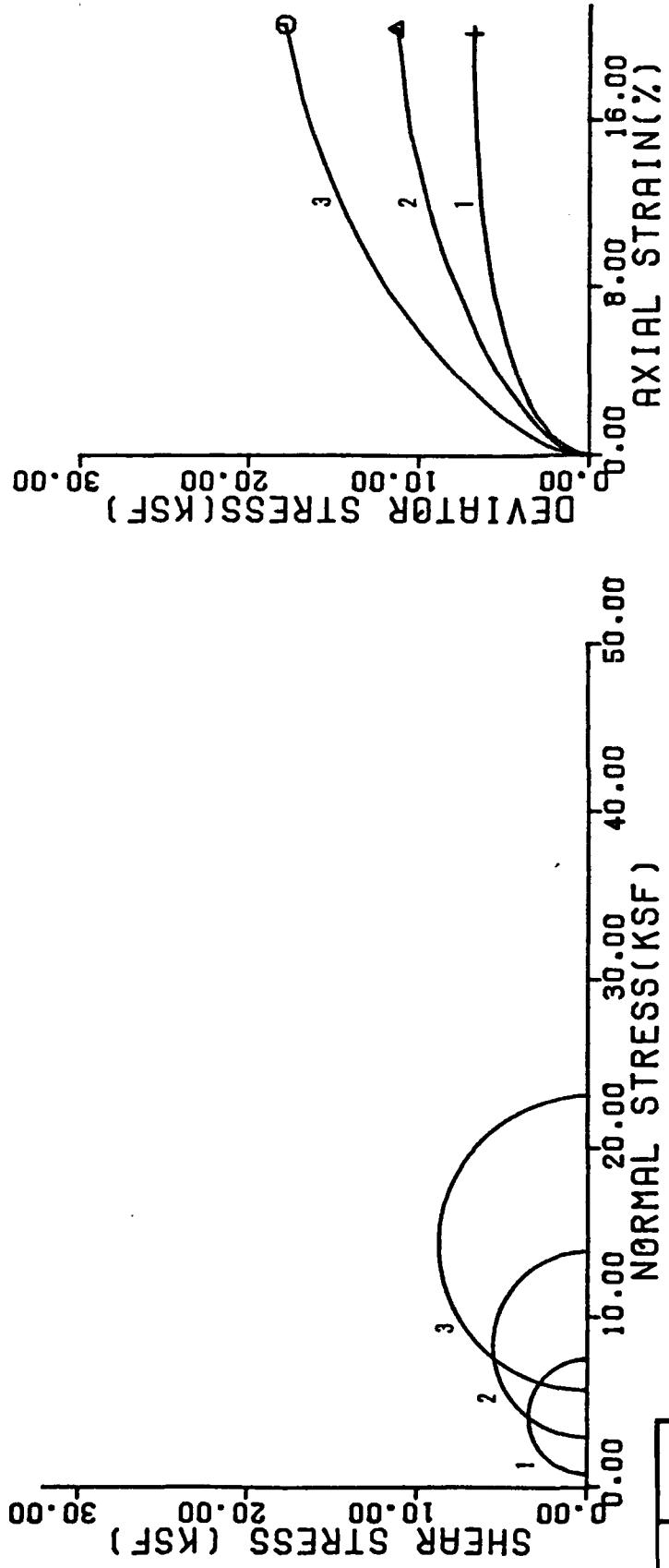
SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL FEET	SAMPLE INTERVAL METERS	CONFINING PRESSURE (σ_3) ksf	CONFINING PRESSURE (σ_3) kN/m ²	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$) ksf	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$) kN/m ²
1	M-14N	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5	5.4	239
2	M-14N	S-3-1	5.0-5.7	1.52-1.74	2.9	138.9	10.6	508
3	M-14N	S-3-2	5.7-6.4	1.74-1.95	5.8	277.7	14.7	704

TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
NAVF TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
8
5 OF 10

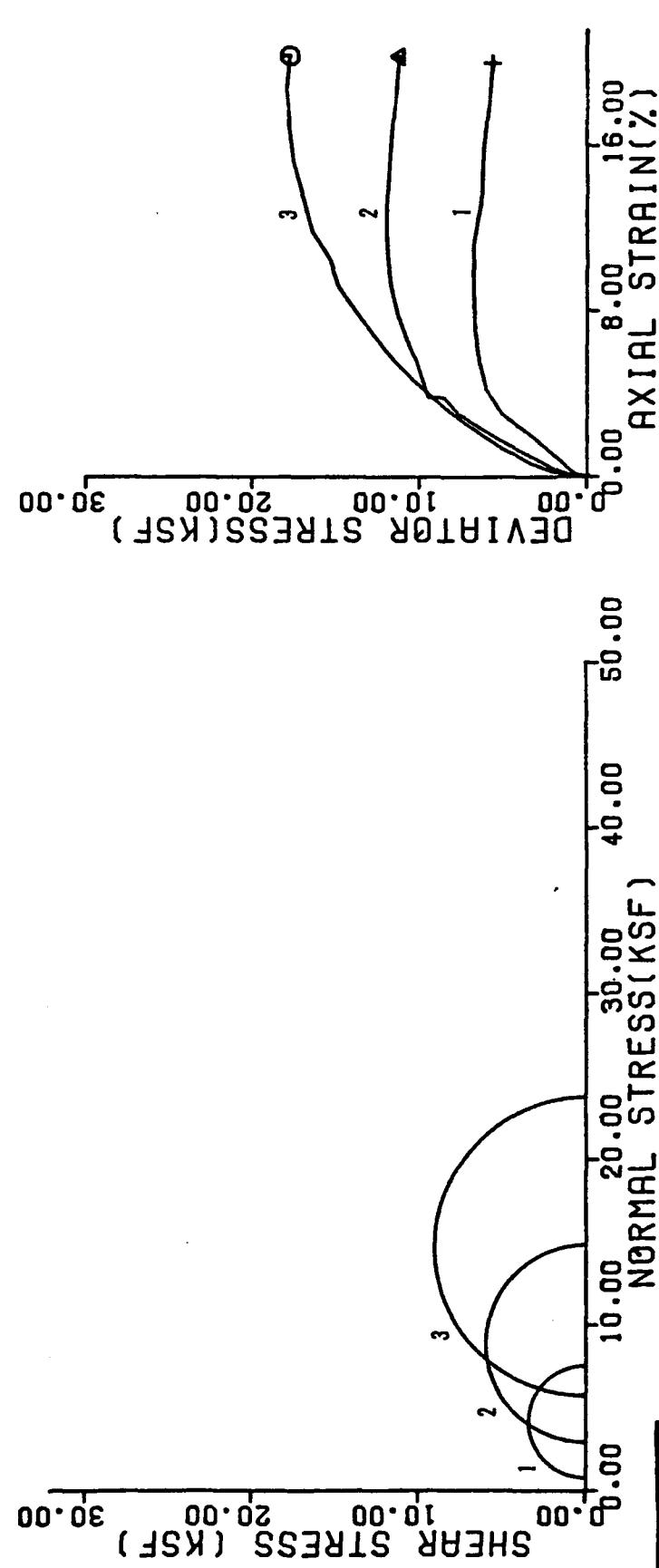
FUGRO NATIONAL, INC.



SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		CONFINING PRESSURE (σ_3)	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$)
			FEET	METERS		
1	M-15S	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5
2	M-15S	S-3-1	5.0-5.7	1.52-1.74	2.9	138.9
3	M-15S	S-3-2	5.7-6.4	1.74-1.95	5.8	277.7

TRIAXIAL COMPRESSION TESTS	
MARTIN MARIETTA GAS SITE	
MAV TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO	FIGURE 8 6 OF 10

FUGRO NATIONAL, INC.



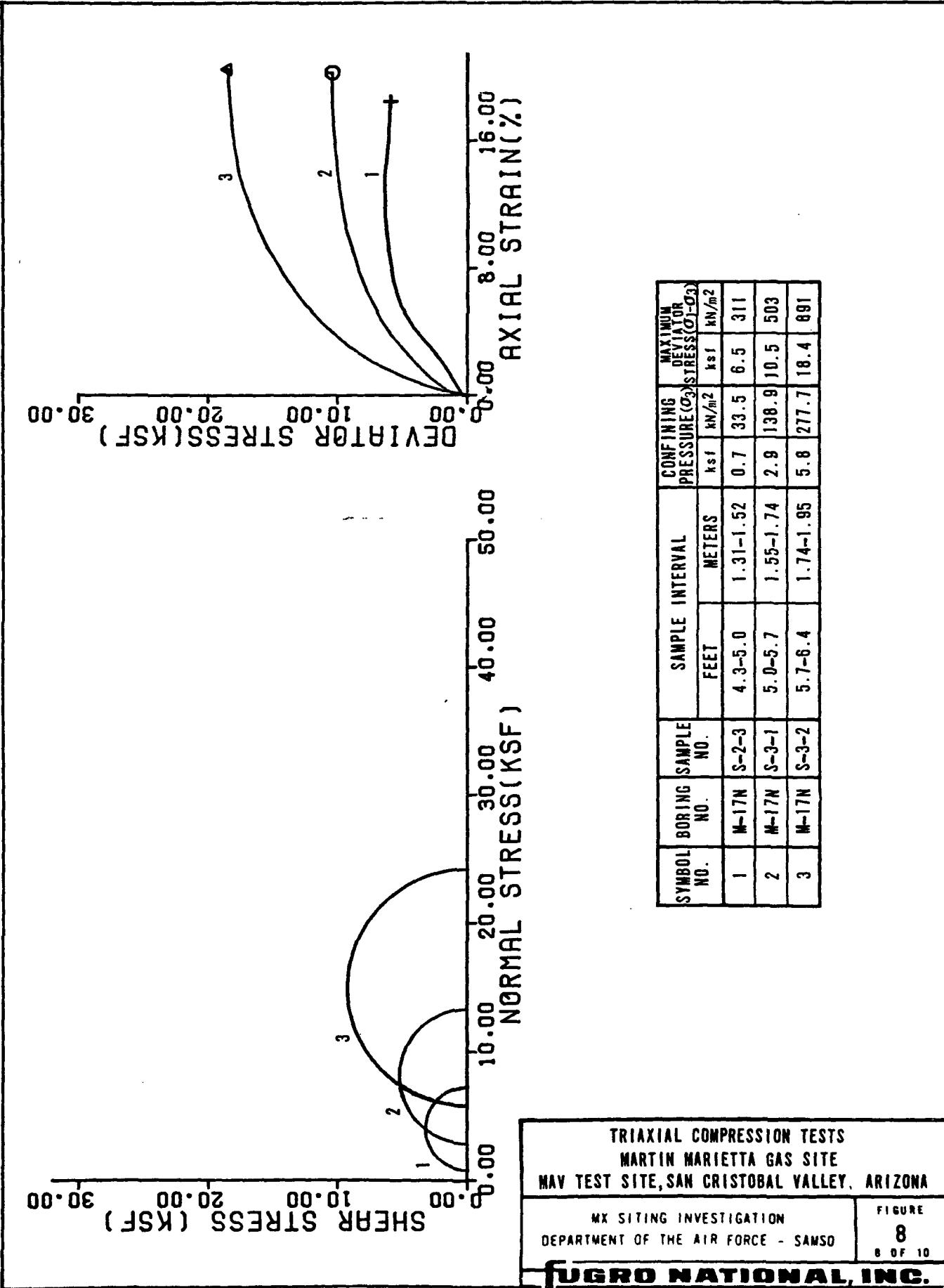
SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		CONFINING PRESSURE (σ_3)	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$)
			FEET	METERS		
1	M-16N	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5
2	M-16N	S-3-1	5.0-5.7	1.52-1.74	2.9	138.9
3	M-16N	S-4-1	7.5-8.2	2.29-2.50	5.8	277.7

TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
8
7 OF 10

FUGRO NATIONAL, INC.



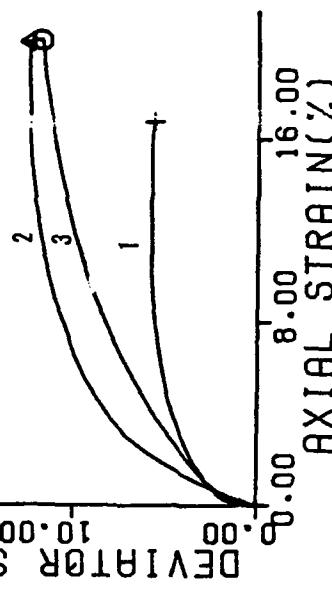
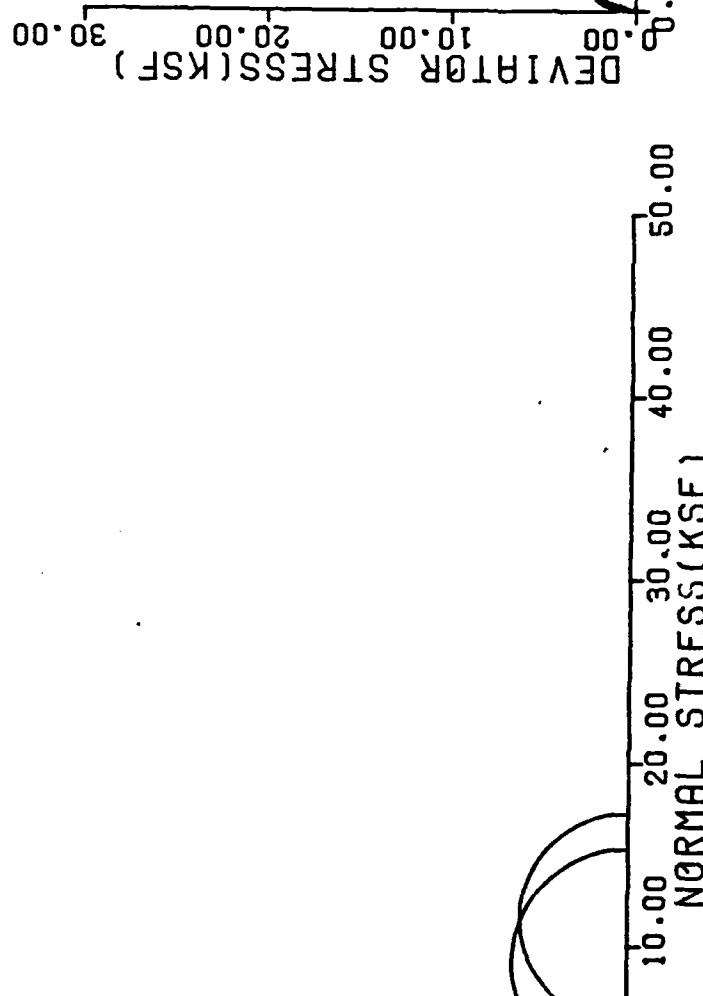
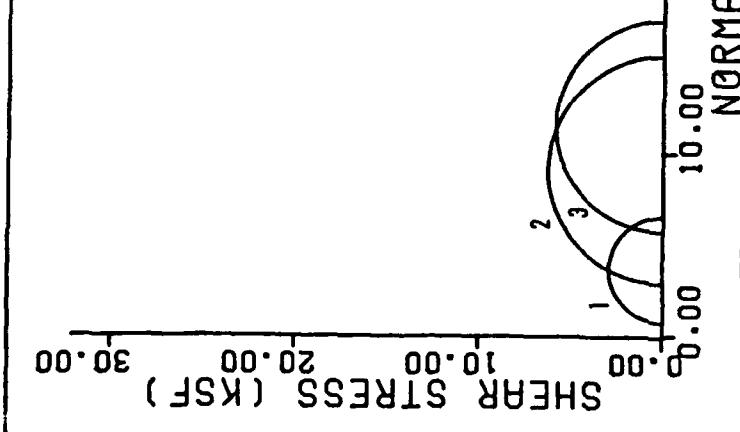
SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		CONFINING PRESSURE σ_3 (KSF)	MAXIMUM DEVIATOR STRESS σ_d (KSF)
			FEET	METERS		
1	M-17N	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5
2	M-17N	S-3-1	5.0-5.7	1.55-1.74	2.9	138.9
3	M-17N	S-3-2	5.7-6.4	1.74-1.95	5.8	277.7

TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
MAV TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
8
8 OF 10

FUGRO NATIONAL, INC.



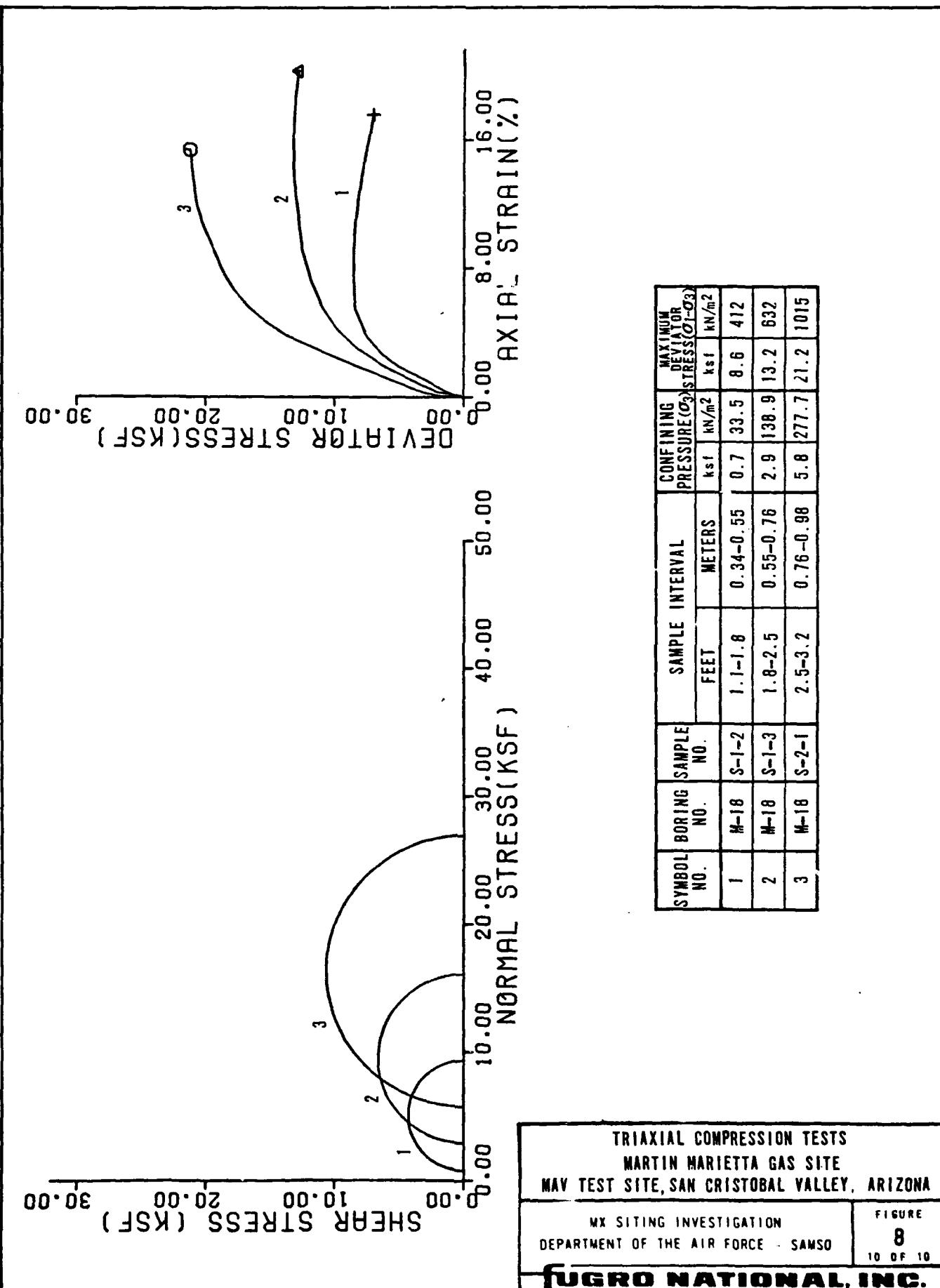
SYMBOL NO.	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL FEET	SAMPLE INTERVAL METERS	CONFINING PRESSURE (σ_3) kN/m ²	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$) kN/m ²
1	M-17S	S-2-3	4.3-5.0	1.31-1.52	0.7	33.5
2	M-17S	S-3-1	5.0-5.7	1.52-1.74	2.9	138.9
3	M-17S	S-3-2	5.7-6.4	1.74-1.95	5.8	277.7

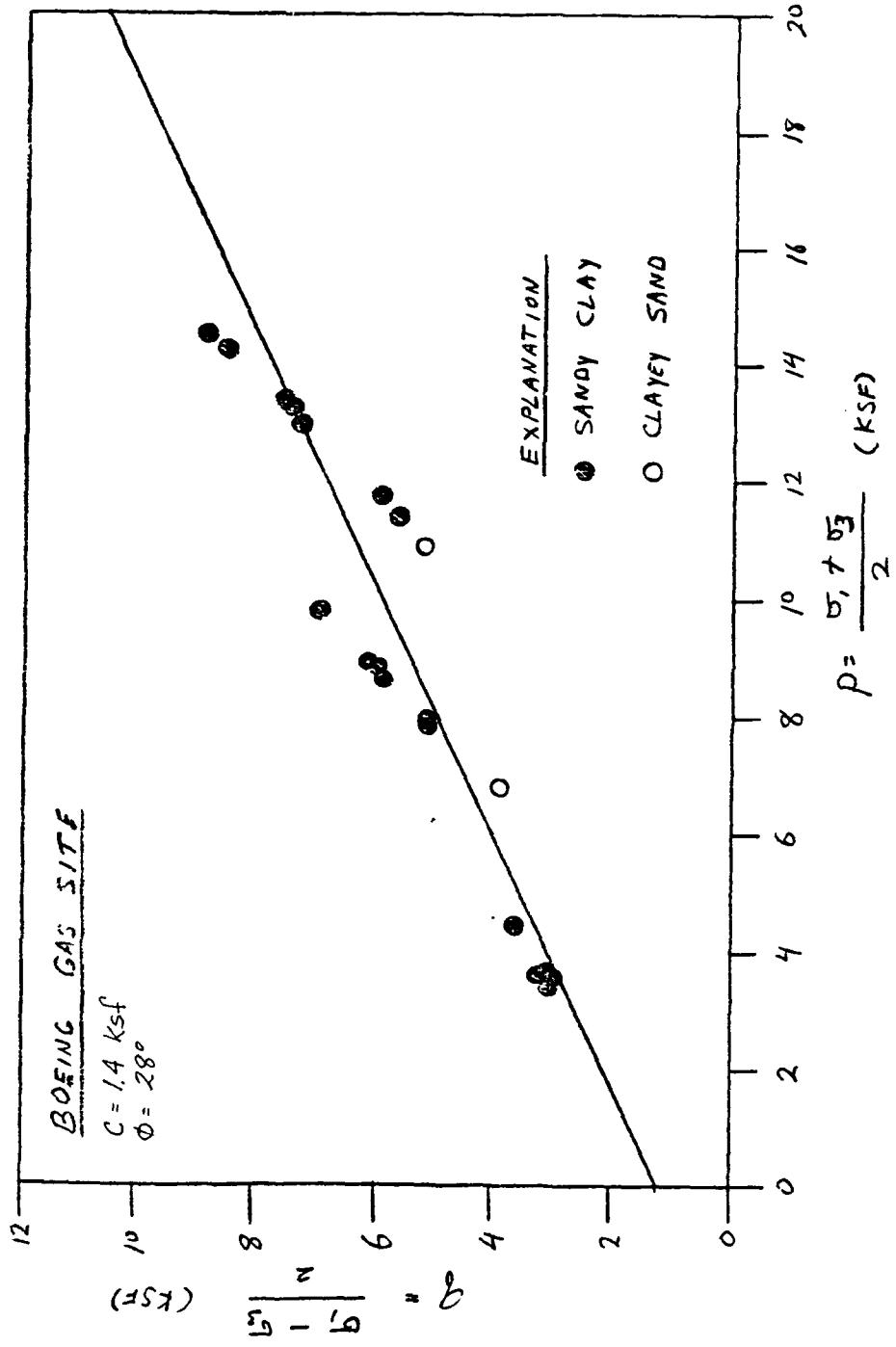
TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
8
9 OF 10

FUGRO NATIONAL, INC.



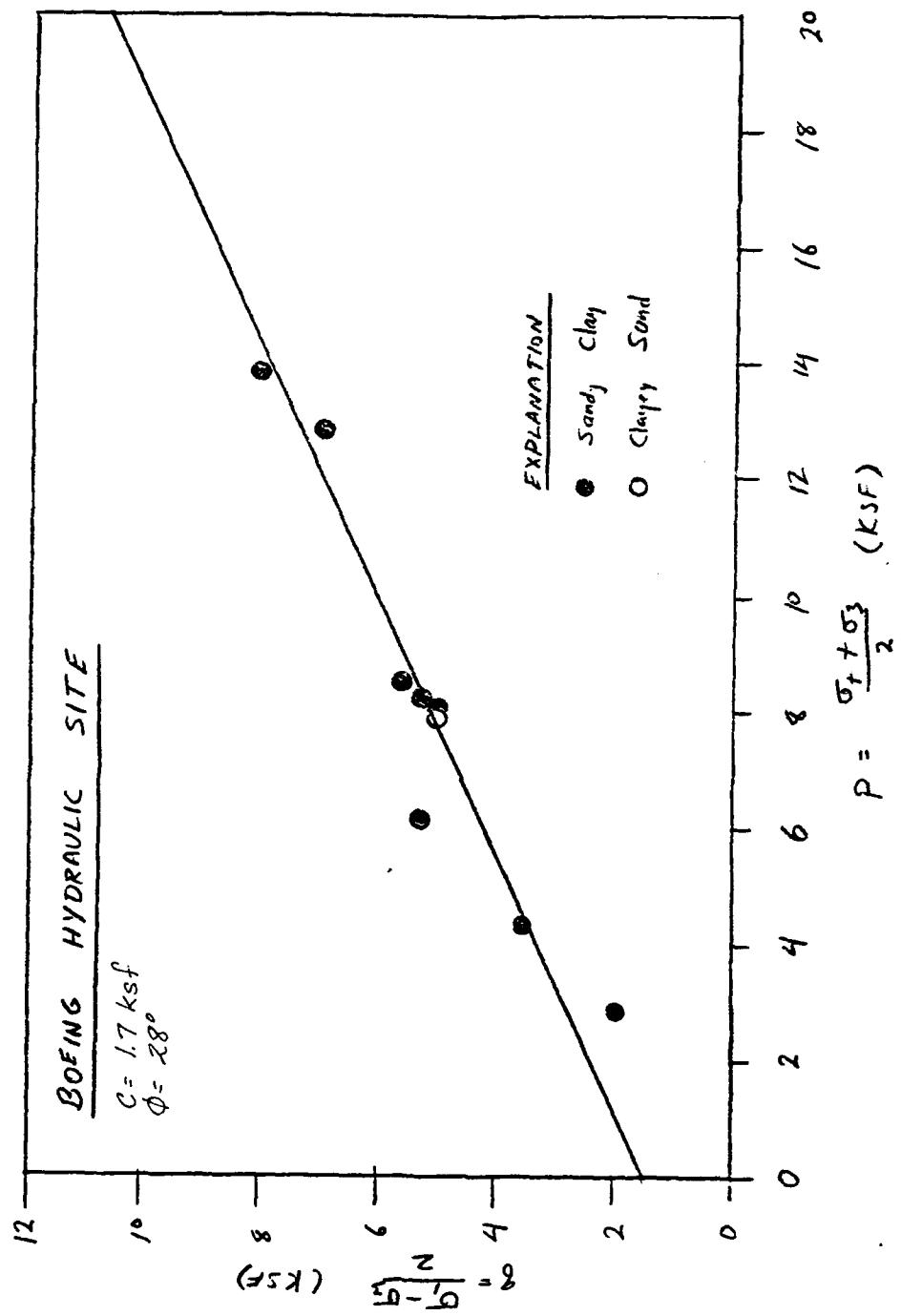


P-Q DIAGRAM-BOEING GAS SITE
MAV TEST SITE
SAN CRISTOBAL VALLEY, ARIZONA

NX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
9

FUGRO NATIONAL, INC.

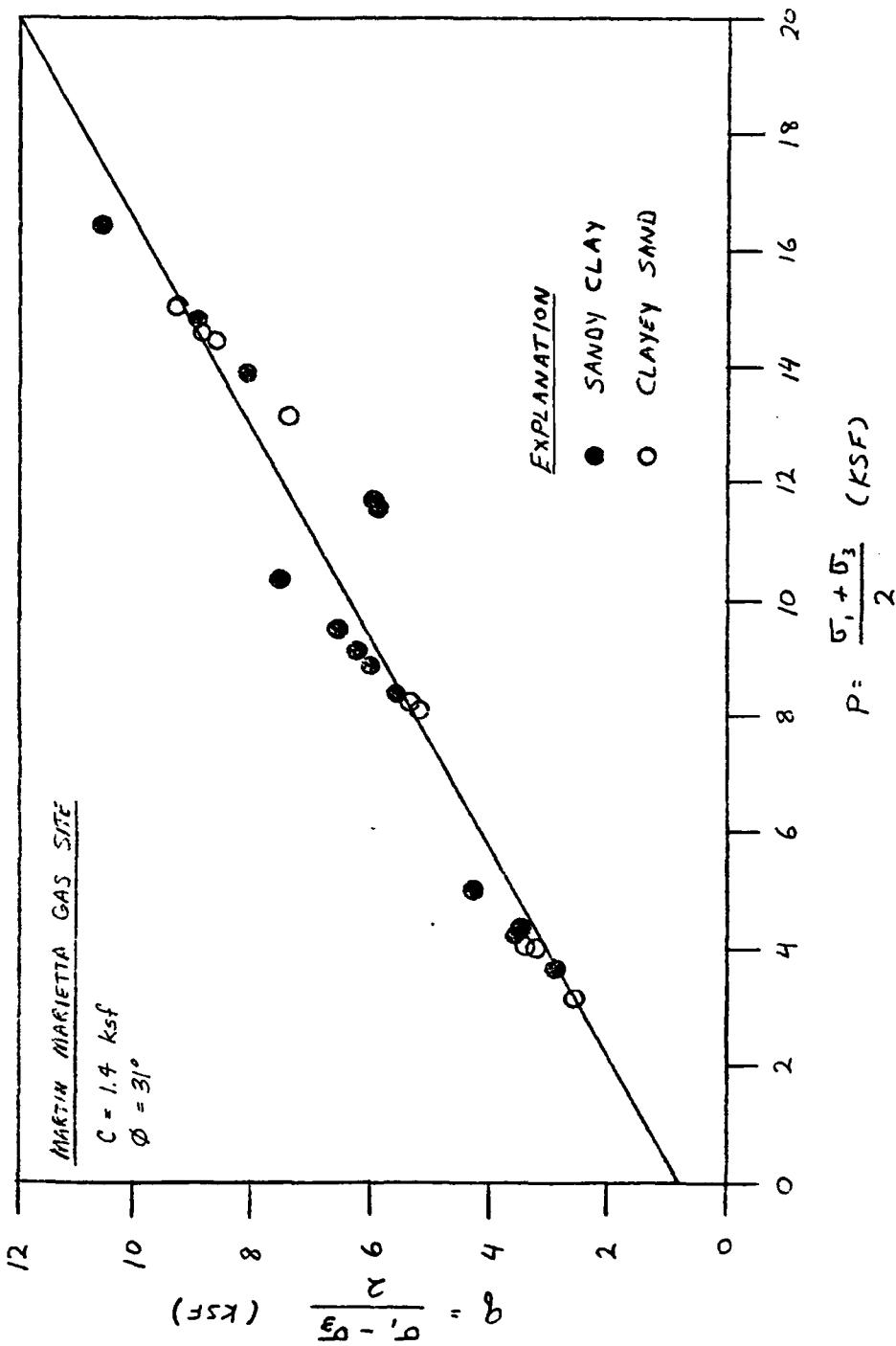


P-Q DIAGRAM-BOEING HYDRAULIC SITE
 MAY TEST SITE
 SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
 DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
 10

FUGRO NATIONAL, INC.



P-Q DIAGRAM-MARTIN MARIETTA GAS
MAV TEST SITE
SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
11

FUGRO NATIONAL, INC.

BORING NO.	DEPTH (FT)	SOIL DESCRIPTION
MAV-B-11	0 - 5.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, occasional fine gravel, gypsum and caliche fragments
MAV-B-12N	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-12S	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-13N	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-14S	0 - 10.0	CLAYEY SAND (SC) brown, fine to medium, poorly graded, subangular to subrounded, medium dense to dense, occasional fine gravel, gypsum and caliche fragments
MAV-B-15N	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-16S	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-17N	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-19	0 - 5.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments

BORING LOGS-BOEING GAS SITE MAY TEST SITE SAN CRISTOBAL VALLEY, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO	TABLE 1
FUGRO NATIONAL, INC.	

BORING NO.	DEPTH (FT)	SOIL DESCRIPTION
MAV-B-33	0 - 2.5	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
	2.5 - 5.0	CLAYEY SAND (SC) brown, fine to medium, poorly graded, subangular to subrounded, medium dense to dense, occasional fine gravel, gypsum and caliche fragments
MAV-B-34N	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-34S	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-36N	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-39S	0 - 10.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-B-41	0 - 5.0	SANDY CLAY (CL) brown, firm to stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments

BORING LOGS-BOEING HYDRAULIC SITE
MAY TEST SITE
SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE
2

FUGRO NATIONAL, INC.

BORING NO.	DEPTH (FT)	SOIL DESCRIPTION
MAV-M-9	0 - 4.5	SANDY CLAY (CL) brown, stiff, low to medium plasticity, occasional fine gravel, gypsum and caliche fragments
MAV-M-11S	0 - 10.0	SANDY CLAY (CL) brown, stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-M-12N	0 - 10.0	CLAYEY SAND (SC) brown, fine to medium, poorly graded, subangular to subrounded, dense, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-M-13S	0 - 10.0	SANDY CLAY (CL) brown, stiff, low to medium plasticity, occasional fine gravel, gypsum and caliche fragments
MAV-M-14N	0 - 10.1	CLAYEY SAND (SC) brown, fine to medium, poorly graded, subangular to subrounded, dense, occasional fine gravel, gypsum and caliche fragments
MAV-M-15S	0 - 10.0	SANDY CLAY (CL) brown, stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-M-16N	0 - 10.0	CLAYEY SAND (SC) brown, fine to coarse, poorly graded, subrounded to subangular, dense, occasional fine gravel, gypsum and caliche fragments
MAV-M-17N	0 - 10.0	CLAYEY SAND (SC) brown, fine to coarse, poorly graded, subangular to subrounded, dense, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-M-17S	0 - 10.0	SANDY CLAY (CL) brown, stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche fragments
MAV-M-18	0 - 4.5	SANDY CLAY (CL) brown, stiff, low to medium plasticity, calcareous, occasional fine gravel, gypsum and caliche

BORING LOGS-MARTIN MARIETTA GAS SITE
MAY TEST SITE
SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE
3

FUGRO NATIONAL, INC.

BORING NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL	PERCENT FINER BY WEIGHT										
			STANDARD SIEVE OPENING							U.S. STANDARD SIEVE			
			BLDRS	COBBLES	GRAVEL					4	10	40	100
		FEET	METERS	24"	12"	6"	3"	1½"	¾"	¾"			
B-11	S-1	0.1-1.1	0.03-0.34										
		1.1-1.8	0.34-0.55										
		1.8-2.5	0.55-0.76										
	S-2	2.6-3.3	0.79-1.01										100 99 98 91 7
		3.6-4.3	1.10-1.22										
		4.0-5.0	1.22-1.52										
B-12N	S-1	0.2-0.9	0.06-0.27										
		0.9-1.6	0.27-0.49										
		1.6-2.5	0.49-0.76										
	S-2	2.5-3.6	0.76-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52										100 98 97 94 84 7
	S-3	5.0-5.7	1.52-1.74										
		5.7-6.4	1.74-1.95										
		6.4-7.5	1.95-2.29										
	S-4	7.5-8.2	2.29-2.50										
		8.2-8.9	2.50-2.71										
		8.9-10.0	2.71-3.05										
B-12S	S-1	0.1-0.8	0.03-0.24										
		0.8-1.5	0.24-0.46										
		1.5-2.5	0.46-0.76										
	S-2	2.7-3.6	0.82-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52										
	S-3	5.0-5.7	1.52-1.74										100 99 96 87 7
		5.7-6.4	1.74-1.95										
		6.4-7.5	1.95-2.29										
	S-4	7.5-8.2	2.29-2.50										
		8.2-8.9	2.50-2.71										
		8.9-10.0	2.71-3.05										
B-13N	S-1	0.2-0.9	0.06-0.27										
		0.9-1.6	0.27-0.49										
		1.6-2.5	0.49-0.76										
	S-2	2.6-3.6	0.79-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52										
	S-3	5.0-5.7	1.52-1.74										
		5.7-6.4	1.74-1.95										100 99 98 89
		6.4-7.5	1.95-2.29										
	S-4	7.5-8.2	2.29-2.50										
		8.2-8.9	2.50-2.71										
		8.9-10.0	2.71-3.05										

NOTES:

(a) Sample types:

S - Shelby Tube Sample

P - Pitcher Barrel Sample

D - Fugro Drive Sample

* Visual classification

** Classification based

*** Test performed and

IRD SIEVE NO.		PARTICLE SIZE (mm)		ATTERBERG LIMITS			USCS*	IN-SITU				COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL	UNCONFINED
		SILT OR CLAY						DRY UNIT WEIGHT	MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY	MINIMUM MOISTURE (%)				
40	100	200	.005	.001	LL	PL	PI	(pcf)	(kg/m³)			(pcf)	(kg/m³)				
								CL	98.6	1579	14.5	55.3	.708				
								CL	106.5	1706	14.5	67.3	.582			***	
91	78	60	0	0	30	15	15	CL**	99.0	1586	14.1	54.2	.702			***	
								CL	96.7	1549	12.1	44.0	.743			***	
								CL	96.4	1544	13.5	48.7	.748			***	
								CL	104.3	1671	11.7	51.2	.615				
								CL	97.7	1565	12.5	46.6	.725				
								CL	103.9	1664	15.2	66.2	.621				
								CL	98.9	1584	13.7	52.8	.703				
84	72	57	20	10	28	19	9	CL**	103.0	1649	10.5	44.9	.636			***	
					33	17	16	CL**	101.6	1627	10.5	42.9	.659			***	
								CL	99.1	1587	13.1	50.6	.701			***	
								CL	102.6	1643	14.6	61.4	.642				
								CL	103.9	1664	14.1	61.1	.622				
								CL	107.6	1724	12.8	61.1	.566				
								CL	102.7	1645	14.2	59.8	.640				
								CL	102.7	1645	9.4	39.5	.640				
								CL	96.2	1541	12.3	44.3	.751				
								CL	101.6	1627	14.9	61.1	.658				
								CL	99.2	1589	14.7	56.7	.699				
								CL	104.5	1674	14.4	63.5	.602			***	
87	77	64	2	0	34	20	14	CL**	103.2	1653	14.7	62.8	.632		2.75	***	
								CL	103.9	1664	15.7	68.2	.622			***	
								CL	102.4	1640	13.9	57.9	.646				
								CL	106.6	1708	12.5	57.9	.581				
								CL	104.9	1680	11.8	52.7	.605				
								CL	110.0	1762	12.0	60.8	.531				
								CL	101.3	1623	8.5	34.5	.662				
								CL	102.4	1640	12.5	52.3	.646				
								CL	102.4	1640	14.4	60.3	.645				
								CL	98.9	1584	14.8	56.9	.704				
								CL	107.2	1716	15.2	72.1	.571				
								CL	101.9	1632	11.8	48.8	.653			***	
								CL	109.0	1746	12.8	63.3	.546			***	
89	78	62	10	0	32	18	14	CL**	103.2	1653	13.8	58.9	.633			***	
								CL	97.0	1554	14.9	54.7	.737				
								CL	99.3	1591	13.2	51.0	.697				
								CL	95.1	1523	13.7	48.1	.771				
								CL	112.8	1807	11.8	64.7	.494				

ification
is based on lab tests
ed and results included in this report

SUMMARY
NAV TEST S
MX SITE DEPARTMENT
fuel

IN-SITU				COMPACTED									
DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	RELATIVE DENSITY
(pcf)	(kg/m³)			(pcf)	(kg/m³)								
98.6	1579	14.5	55.3	.708									
106.5	1706	14.5	67.3	.582				***					
99.0	1586	14.1	54.2	.702				***					
96.7	1549	12.1	44.0	.743				***					
96.4	1544	13.5	48.7	.748				***					
104.3	1671	11.7	51.2	.615									
97.7	1565	12.5	46.6	.725									
103.9	1664	15.2	66.2	.621									
98.9	1584	13.7	52.8	.703									
103.0	1649	10.5	44.9	.636				***					
101.6	1627	10.5	42.9	.659				***					
99.1	1587	13.1	50.6	.701				***					
102.6	1643	14.6	61.4	.642									
103.9	1664	14.1	61.1	.622									
107.6	1724	12.8	61.1	.566									
102.7	1645	14.2	59.8	.640									
102.7	1645	9.4	39.5	.640									
96.2	1541	12.3	44.3	.751									
101.6	1627	14.9	61.1	.658									
99.2	1589	14.7	56.7	.699									
104.5	1674	14.4	63.5	.602				***					
103.2	1653	14.7	62.8	.632		2.75		***					
103.9	1664	15.7	68.2	.622				***					
102.4	1640	13.9	57.9	.646									
106.6	1708	12.5	57.9	.581									
104.9	1680	11.8	52.7	.605									
110.0	1762	12.0	60.8	.531									
101.3	1623	8.5	34.5	.662									
102.4	1640	12.5	52.3	.646									
102.4	1640	14.4	60.3	.645									
98.9	1584	14.8	56.9	.704									
107.2	1716	15.2	72.1	.571									
101.9	1632	11.8	48.8	.653				***					
109.0	1746	12.8	63.3	.546				***					
103.2	1653	13.8	58.9	.633				***					
97.0	1554	14.9	54.7	.737									
99.3	1591	13.2	51.0	.697									
95.1	1523	13.7	48.1	.771									
112.8	1807	11.8	64.7	.494									

SUMMARY OF LABORATORY TEST RESULTS BOEING GAS SITE MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA		TABLE 4 1 RF 3
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO		
FUBRO NATIONAL, INC.		

8.3-9.0	2.53-2.74				
9.0-10.0	2.74-3.05				
0.2-0.9	0.06-0.27				
0.9-1.6	0.27-0.49				
1.6-2.5	0.49-0.76				
2.6-3.6	0.79-1.10				
3.6-4.3	1.10-1.31				
4.3-5.0	1.31-1.52				
5.0-5.7	1.52-1.74				
5.7-6.4	1.74-1.95				
6.4-7.5	1.95-2.29				
7.5-8.2	2.29-2.50				
8.2-8.9	2.50-2.71				
8.9-10.0	2.71-3.05				
0.1-0.8	0.03-0.24				
0.8-1.5	0.24-0.46				
1.5-2.5	0.46-0.76				
2.7-3.6	0.82-1.10				
3.6-4.3	1.10-1.31				
4.3-5.0	1.31-1.52				
5.0-5.7	1.52-1.74				
5.7-6.4	1.74-1.95				
6.4-7.5	1.95-2.29				
7.7-8.4	2.35-2.56				

				ATTERBERG LIMITS			USCS*	IN-SITU				COMPACTED		SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL UNCONFINED COMPRESSION	
SIEVE NO.		PARTICLE SIZE (mm)		LL		PL		DRY UNIT WEIGHT (pcf) (kg/m³)		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY (pcf) (kg/m³)	OPTIMUM MOISTURE (%)		
SILT OR CLAY																
D	100	200	.005	.001												
					SC	95.4	1528	7.8	27.7	.765						
					SC	95.6	1531	14.8	52.5	.762						
					SC	97.1	1555	14.4	53.0	.735						
					SC	93.3	1495	15.1	50.8	.805						
					SC	89.8	1437	16.2	49.8	.875						
					SC	108.5	1737	14.9	72.7	.553						***
1	49	36	0	0	32	17	15	SC**	105.0	1682	14.6	65.2	.605			***
					SC	106.0	1698	15.5	71.1	.589						***
					SC	111.8	1790	12.4	66.0	.507						***
					SC	102.8	1647	12.1	51.3	.639						
					SC	102.4	1640	12.1	50.7	.645						
					CL	103.5	1658	8.1	34.7	.627						
					CL	101.2	1621	10.8	43.7	.665						
					CL	98.9	1584	14.3	55.1	.702						
					CL	95.9	1536	14.5	51.8	.757						
					CL	101.2	1620	15.2	61.7	.665						***
					CL	110.8	1775	14.3	74.1	.521						***
0	80	77	28	1	32	20	12	CL**	109.1	1748	13.5	67.0	.544			***
					CL	97.2	1557	13.5	49.7	.733						
					CL	95.2	1525	14.1	49.5	.770						
					CL	104.3	1671	12.3	54.2	.615						
					CL	104.6	1676	12.4	54.6	.611						
					CL	101.2	1621	11.7	47.5	.664						
					CL	100.8	1615	13.3	53.4	.671						
					CL	96.7	1549	14.8	53.9	.742						
					CL	98.3	1575	14.4	54.5	.714						
					CL	98.9	1584	15.0	57.4	.703						
					CL	92.9	1487	13.9	46.2	.814						
					CL	102.4	1639	14.3	59.8	.645						
					CL	105.2	1684	14.5	65.2	.602						
					CL	105.5	1689	15.7	70.9	.597						
					CL	104.9	1680	16.3	77.8	.606						
					CL	105.0	1682	13.5	60.3	.604						
					CL	102.5	1642	12.3	51.5	.647						
					CL	108.7	1741	11.4	56.1	.549						
					CL	96.1	1539	11.4	40.9	.754						
					CL	101.4	1624	11.0	44.7	.662						
					CL	103.5	1658	15.4	66.1	.628						
					CL	98.3	1575	14.7	55.6	.713						
					CL	104.2	1669	13.8	60.4	.617						***

SUMMARY

NAV TEST SITE

MX SITING
DEPARTMENT OF

ication
 based on lab tests
 and results included in this report

FUGRO

CS*	IN-SITU				COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	RELATIVE DENSITY
	DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)							
	(pcf)	(kg/m³)			(pcf)	(kg/m³)								
C	95.4	1528	7.8	27.7	.765									
C	95.6	1531	14.8	52.5	.762									
C	97.1	1555	14.4	53.0	.735									
C	93.3	1495	15.1	50.8	.805									
C	89.8	1437	16.2	49.8	.875									
C	108.5	1737	14.9	72.7	.553				***					
C**	105.0	1682	14.6	65.2	.605				***					
C	106.0	1698	15.5	71.1	.589				***					
C	111.8	1790	12.4	66.0	.507				***					
C	102.8	1647	12.1	51.3	.639									
C	102.4	1640	12.1	50.7	.645									
CL	103.5	1658	8.1	34.7	.627									
CL	101.2	1621	10.8	43.7	.665									
CL	98.9	1584	14.3	55.1	.702									
CL	95.9	1536	14.5	51.8	.757									
CL	101.2	1620	15.2	61.7	.665				***					
CL	110.8	1775	14.3	74.1	.521				***					
CL**	109.1	1748	13.5	67.0	.544				***					
CL	97.2	1557	13.5	49.7	.733									
CL	95.2	1525	14.1	49.5	.770									
CL	104.3	1671	12.3	54.2	.615									
CL	104.6	1676	12.4	54.6	.611									
CL	101.2	1621	11.7	47.5	.664									
CL	100.8	1615	13.3	53.4	.671									
CL	96.7	1549	14.8	53.9	.742									
CL	98.3	1575	14.4	54.5	.714									
CL	98.9	1584	15.0	57.4	.703									
CL	92.9	1487	13.9	46.2	.814									
CL	102.4	1639	14.3	59.8	.645									
CL	105.2	1684	14.5	65.2	.602									
CL	105.5	1689	15.7	70.9	.597									
CL	104.9	1680	16.3	77.8	.606									
CL	105.0	1682	13.5	60.3	.604									
CL	102.5	1642	12.3	51.5	.647									
CL	108.7	1741	11.4	56.1	.549									
CL	96.1	1539	11.4	40.9	.754									
CL	101.4	1624	11.0	44.7	.662									
CL	103.5	1658	15.4	66.1	.628									
CL	98.3	1575	14.7	55.6	.713									
CL	104.2	1669	13.8	60.4	.617				***					

SUMMARY OF LABORATORY TEST RESULTS BOEING GAS SITE NAVFTEST SITE, SAN CRISTOBAL VALLEY, ARIZONA		TABLE 4 2 OF 3
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO		
FUGRO NATIONAL, INC.		

NOTES:

(a) Sample types:

S - Shelby Tube Sample

P - Pitcher Barrel Sample

D - Fugro Drive Sample

* Visual classification

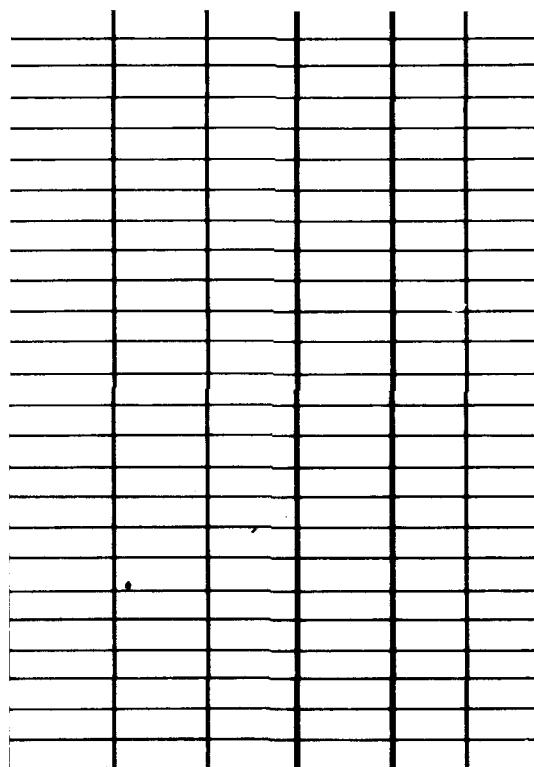
** Classification b

*** Test performed and

TEST						USCS *	IN-SITU				COMPACTED			TRIAxIAL	
STANDARD SIEVE NO.			PARTICLE SIZE (mm)		ATTERBERG LIMITS			DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY	OPTIMUM MOISTURE (%)	
SAND	SILT OR CLAY		LL	PL	PI		(pcf)	(kg/m³)					(pcf)	(kg/m³)	
10	40	100	200	.005	.001	CL **	113.5	1818	12.6	70.3	.484				
97	88	78	65	25	7	29	17	12	CL **	108.9	1744	13.6	67.1	.547	
						CL	97.9	1568	14.6	54.5	.721				
						CL	107.4	1720	12.3	58.5	.568				
						CL	104.1	1668	11.5	50.2	.618				
						CL	97.6	1563	10.9	40.5	.727				
						CL	97.2	1556	14.8	54.6	.733				
						CL	102.9	1647	14.3	60.5	.636				
						CL	100.6	1610	16.2	64.9	.674				
						CL	102.1	1634	13.7	56.8	.650				
						CL	88.5	1417	13.4	39.9	.903				
						CL	93.3	1495	12.3	41.4	.806				

Classification
Speciation based on lab tests
performed and results included in this report

ST
NAV TEC
DEPART
fud



BORING NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL	PERCENT FINER BY WEIGHT										
			STANDARD SIEVE OPENING							U S STANDARD			
			BLDRS.	COBBLES	GRAVEL					4	10	40	
		FEET	METERS	24"	12"	6"	3"	1½"	¾"	3/8"	4	10	40
B-33	S-1	0.3-1.1	0.09-0.34										
		1.1-1.8	0.34-0.55								100	99	96
		1.8-2.5	0.55-0.76								100	99	97
	S-2	2.7-3.4	0.82-1.04										
		3.4-4.1	1.04-1.25								100	98	95
		4.1-5.0	1.25-1.52								95	91	76
B-34N	D-1	0.7-1.4	0.21-0.43										
	D-2	2.1-2.8	0.64-0.85										
	P-3	3.2-4.4	0.98-1.34										
		4.4-4.8	1.34-1.46										
		4.8-5.5	1.46-1.68										
	S-4	5.7-6.4	1.74-1.95								100	99	94
		6.4-7.1	1.95-2.16										
		7.1-8.0	2.16-2.44										
	S-5	8.0-8.7	2.44-2.65										
		8.7-9.4	2.65-2.87										
		9.4-10.0	2.87-3.05										
B-34S	S-1	0.1-0.8	0.03-0.24										
		0.8-1.5	0.24-0.46										
		1.5-2.5	0.46-0.76										
	S-2	3.0-3.6	0.91-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52								100	99	96
	S-3	5.1-5.8	1.55-1.77								100	98	96
		5.8-6.5	1.77-1.98								100	99	95
		6.5-7.5	1.98-2.29										
	S-4	7.9-8.6	2.41-2.62										
		8.6-9.3	2.62-2.83										
		9.3-10.0	2.83-3.05										
B-36N	S-1	0.2-0.9	0.06-0.27										
		0.9-1.6	0.27-0.49										
		1.6-2.5	0.49-0.76										
	S-2	2.5-3.6	0.76-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52										
	S-3	5.1-5.8	1.55-1.77										
		5.8-6.5	1.77-1.98								100	98	94
		6.5-7.5	1.98-2.29										
	S-4	7.6-8.3	2.32-2.53										
		8.3-9.0	2.53-2.74										
		9.0-10.0	2.74-3.05										

NOTES:

(a) Sample types:

- S - Shelby Tube Sample
- P - Pitcher Barrel Sample
- D - Fugro Drive Sample

* Visual classification

** Classification

*** Test performed

TEST							USCS *	IN-SITU				COMPACTED			SPECIFIC GRAVITY OF SOLIDS	MAXIMUM DENSITY
STANDARD SIEVE NO.			PARTICLE SIZE (mm)		ATTERBERG LIMITS			DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY			
SAND	SILT OR CLAY		200	.005	.001	LL	PL	PI	(pcf)	(kg/m³)			(pcf)	(kg/m³)		
10	40	100														
96	89	79	63	24	4	33	16	17	CL	98.7	1580	10.0	38.1	.706		
97	89	79	66	24	4				CL**	103.8	1663	13.8	59.7	.623		
									CL**	95.0	1522	14.7	51.3	.773		
91	76	63	48	18	5				SC	103.0	1650	12.3	52.1	.636		
									SC**	95.1	1523	13.2	46.1	.772		
									SC	90.1	1442	12.5	38.9	.869		
									CL	99.4	1592	20.3	78.8	.695		
									CL	116.5	1866	14.7	89.1	.446		
									CL	100.1	1603	14.9	58.8	.684		
									CL	102.2	1636	11.5	47.9	.648		
									CL	99.7	1596	15.1	59.1	.690		
94	81	67	53	24	5	29	19	10	CL**	107.7	1724	12.5	59.8	.564		
									CL	105.6	1690	13.1	59.4	.595		
									CL	97.5	1562	13.9	51.5	.728		
									CL	105.9	1696	13.1	59.7	.592		
									CL	104.5	1674	11.7	51.9	.611		
									CL	101.9	1632	11.6	48.1	.652		
									CL	105.4	1688	8.9	40.1	.599		
									CL	92.1	1475	12.5	40.7	.830		
									CL	100.6	1611	14.3	57.1	.674		
									CL	106.8	1711	13.6	63.7	.577		
									CL	105.2	1685	14.3	64.1	.602		
96	88	78	65	29	3				CL**	115.2	1845	14.3	83.5	.463		
96	88	77	63	12	2	32	17	15	CL**	99.6	1595	12.3	48.0	.691	2.66	
95	84	72	58	21	1				CL**	99.2	1589	13.7	53.0	.698		
									CL	92.2	1477	17.2	56.1	.827		
									CL	117.9	1889	8.6	54.4	.429		
									CL	101.9	1632	12.4	51.4	.654		
									CL	97.1	1555	12.8	47.2	.735		
									CL	101.8	1631	9.4	38.5	.656		
									CL	105.5	1690	15.2	68.8	.596		
									CL	105.4	1688	13.4	60.3	.599		
									CL	102.9	1648	16.9	71.9	.636		
									CL	105.2	1685	12.8	57.6	.602		
									CL	113.6	1820	14.4	80.5	.483		
									CL	113.1	1812	12.5	68.9	.490		
94	84	74	60	16	0	28	16	12	CL**	97.6	1563	12.1	45.0	.726		
									CL	100.9	1616	13.2	53.3	.670		
									CL	106.4	1704	14.0	64.9	.583		
									CL	102.4	1640	13.4	56.0	.645		
									CL	109.3	1751	11.8	58.9	.542		

I classification
ification based on lab tests
performed and results included in this report

NAW

DEPM

USCS *	IN-SITU				COMPACTED				TRIAXIAL	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	RELATIVE DENSITY						
	DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)												
	(pcf)	(kg/m³)				(pcf)	(kg/m³)													
CL	98.7	1580	10.0	38.1	.706															
CL**	103.8	1663	13.8	59.7	.623					***										
CL**	95.0	1522	14.7	51.3	.773					***										
SC	103.0	1650	12.3	52.1	.636															
SC**	95.1	1523	13.2	46.1	.772					***										
SC	90.1	1442	12.5	38.9	.869															
CL	99.4	1592	20.3	78.8	.695															
CL	116.5	1866	14.7	89.1	.446															
CL	100.1	1603	14.9	58.8	.684															
CL	102.2	1636	11.5	47.9	.648															
CL	99.7	1596	15.1	59.1	.690					***										
CL**	107.7	1724	12.5	59.8	.564					***										
CL	105.6	1690	13.1	59.4	.595					***										
CL	97.5	1562	13.9	51.5	.728															
CL	105.9	1696	13.1	59.7	.592															
CL	104.5	1674	11.7	51.9	.611															
CL	101.9	1632	11.6	48.1	.652															
CL	105.4	1688	8.9	40.1	.599															
CL	92.1	1475	12.5	40.7	.830															
CL	100.6	1611	14.3	57.1	.674															
CL	106.8	1711	13.6	63.7	.577															
CL	105.2	1685	14.3	64.1	.602															
CL**	115.2	1845	14.3	83.5	.463					***										
CL**	99.6	1595	12.3	48.0	.691		2.66													
CL**	99.2	1589	13.7	53.0	.698					***										
CL	92.2	1477	17.2	56.1	.827					***										
CL	117.9	1889	8.6	54.4	.429															
CL	101.9	1632	12.4	51.4	.654															
CL	97.1	1555	12.8	47.2	.735															
CL	101.8	1631	9.4	38.5	.656															
CL	105.5	1690	15.2	68.8	.596															
CL	105.4	1688	13.4	60.3	.599															
CL	102.9	1648	16.9	71.9	.636															
CL	105.2	1685	12.8	57.6	.602															
CL	113.6	1820	14.4	80.5	.483					***										
CL	113.1	1812	12.5	68.9	.490					***										
CL**	97.6	1563	12.1	45.0	.726					***										
CL	100.9	1616	13.2	53.3	.670															
CL	106.4	1704	14.0	64.9	.583															
CL	102.4	1640	13.4	56.0	.645															
CL	109.3	1751	11.8	58.9	.542															

SUMMARY OF LABORATORY TEST RESULTS BOEING HYDRAULIC SITE MAV TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA		TABLE 5 1 OF 2
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO		

FUGRO NATIONAL, INC.

BORING NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL	PERCENT FINER BY WEIGHT							
			STANDARD SIEVE OPENING						U S STANDARD	
			BLDRS.	COBBLES	GRAVEL				SAND	
		FEET	METERS	24"	12"	6"	3"	1½"	¾"	3/8"
B-39S	S-1	0.1-0.8	0.03-0.24							
		0.8-1.5	0.24-0.46							
		1.5-2.5	0.46-0.76							
	S-2	2.6-3.6	0.79-1.10							
		3.6-4.3	1.10-1.31							
		4.3-5.0	1.31-1.52							
	S-3	5.0-5.7	1.52-1.74							
		5.7-6.4	1.74-1.95							
		6.4-7.5	1.95-2.29							
	S-4	7.5-8.2	2.29-2.50							
		8.2-8.9	2.50-2.71							
		8.9-10.0	2.71-3.05							
B-41	S-1	0.3-1.1	0.09-0.34							
		1.1-1.8	0.34-0.55							
		1.8-2.5	0.55-0.76							
	S-2	2.7-3.4	0.82-1.04							
		3.4-4.1	1.04-1.25							
		4.1-5.0	1.25-1.52							

NOTES:

(a) Sample types:

S - Shelby Tube Sample

P - Pitcher Barrel Sample

D - Fugro Drive Sample

- * Visual classification
- ** Classification
- *** Test performance

EIGHT						USCS *	IN-SITU				COMPACTED			SPECIFIC GRAVITY OF SOLIDS		
STANDARD SIEVE NO.			PARTICLE SIZE (mm)		ATTERBERG LIMITS			DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY			
SAND	SILT OR CLAY	LL	PL	PI	(pcf)	(kg/m³)	(%)	(%)	(%)	(pcf)	(kg/m³)	OPTIMUM MOISTURE (%)				
10	40	100	200	.005	.001	CL	102.5	1642	10.0	42.0	.643					
						CL	100.1	1603	12.7	50.3	.683					
						CL	100.8	1615	16.7	67.5	.671					
						CL	97.8	1567	14.9	55.7	.723					
						CL	101.6	1626	14.5	59.4	.658					
						CL	97.2	1556	14.8	54.4	.733					
						CL	101.8	1629	15.0	61.7	.655					
						CL	96.5	1545	14.2	51.3	.745					
						CL	90.0	1442	18.0	55.8	.871					
						CL	101.2	1621	11.9	48.3	.665					
						CL	102.3	1639	12.5	52.3	.647					
						CL	103.2	1653	11.1	47.4	.633					
						CL	98.8	1583	11.3	43.4	.705					
						CL	98.1	1570	11.2	42.2	.717					
						CL	111.6	1786	12.9	68.0	.510					
						CL	96.6	1546	13.4	48.6	.745					
						CL	95.2	1524	12.9	45.2	.769					
						CL	93.5	1498	12.3	41.3	.801					

Classification
Classification based on lab tests
performed and results included in this report

MAY 1

DEPM

F

**SUMMARY OF LABORATORY TEST RESULTS
BOEING HYDRAULIC SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA**

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE
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2 OF 2

FUGRO NATIONAL, INC.

BORING NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL	PERCENT FINER BY WEIGHT									
			STANDARD SIEVE OPENING						U S STANDARD			
			BLDRS	COBBLES	GRAVEL				4	10	40	
		FEET	METERS	24"	12"	6"	3"	1½"	¾"	¾"		
M-9	S-1	0.7-1.1	0.21-0.34									
		1.1-1.8	0.34-0.55									
		1.8-2.5	0.55-0.76									100 96 83
M-11S	S-2	2.5-3.2	0.76-0.98									
		3.2-3.9	0.98-1.19									
		3.9-4.5	1.19-1.37									
M-11S	S-1	0.2-0.9	0.06-0.27									
		0.9-1.6	0.27-0.49									
		1.6-2.5	0.49-0.76									
M-11S	S-2	2.7-3.6	0.82-1.1									
		3.6-4.3	1.10-1.31									
		4.3-5.0	1.31-1.52									
M-11S	S-3	5.2-5.9	1.58-1.80									100 96
		5.9-6.6	1.80-2.01									
		6.6-7.5	2.01-2.29									
M-11S	S-4	7.5-8.2	2.29-2.50									
		8.2-8.9	2.50-2.71									
		8.9-10.0	2.71-3.05									
M-12N	S-1	0.2-0.9	0.06-0.27									
		0.9-1.6	0.27-0.49									
		1.6-2.5	0.49-0.76									
M-12N	S-2	2.5-3.6	0.76-1.10									
		3.6-4.3	1.10-1.31									
		4.3-5.0	1.31-1.52									
M-12N	S-3	5.0-5.7	1.52-1.74							100	98	92 88 68
		5.7-6.4	1.74-1.95									
		6.4-7.5	1.95-2.29									
M-12N	S-4	7.5-8.2	2.29-2.50									
		8.2-8.9	2.50-2.71									
		8.9-10.0	2.71-3.05									
M-13S	S-1	0.1-0.8	0.03-0.24									
		0.8-1.5	0.24-0.46									
		1.5-2.5	0.46-0.76									
M-13S	S-2	2.5-3.6	0.76-1.10									
		3.6-4.3	1.10-1.31									
		4.3-5.0	1.31-1.52									
M-13S	S-3	5.0-5.7	1.52-1.74							100	98	93
		5.7-6.4	1.74-1.95									
		6.4-7.5	1.95-2.29									
M-13S	S-4	7.5-8.2	2.29-2.50									
		8.2-8.9	2.50-2.71									
		8.9-10.0	2.71-3.05									

NOTES:

(a) Sample types:

S - Shelby Tube Sample

P - Pitcher Barrel Sample

D - Fugro Drive Sample

* Visual classification

** Classification

*** Test performed

RD SIEVE NO.		PARTICLE SIZE (mm)		ATTERBERG LIMITS			USCS*	IN-SITU				COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL	UNCONFINED COMPRESSION
		SILT OR CLAY						DRY UNIT WEIGHT	MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY	OPTIMUM MOISTURE (%)				
40	100	200	.005	.001	LL	PL	PI	(pcf)	(kg/m³)	(%)	(%)	(pcf)	(kg/m³)				
								CL	95.3	1527	7.1	24.9	.767				
83	70	57	24	14	30	15	15	CL**	98.2	1572	10.9	41.1	.716		***		
								CL	104.2	1668	13.5	59.3	.617		***		
								CL	104.1	1666	13.6	59.4	.618		***		
								CL	93.9	1504	11.8	40.1	.794				
								CL	98.2	1573	12.3	46.6	.715				
								CL	105.1	1684	13.1	58.7	.602				
								CL	107.8	1727	12.8	61.4	.563				
								CL	105.2	1685	14.0	62.7	.602		***		
								CL	112.3	1799	13.0	71.5	.501				
96	88	75	32	10	31	17	14	CL**	109.2	1749	13.8	68.6	.543		***		
								CL	97.1	1554	13.0	47.9	.735		***		
								CL	102.8	1647	13.8	53.3	.639				
								CL	93.7	1501	12.5	42.3	.797				
								CL	93.8	1503	13.3	45.1	.797				
								SC	103.0	1650	5.4	23.1	.636				
								SC	112.6	1804	10.9	59.8	.496				
								SC	114.2	1829	11.2	64.1	.470				
								SC	105.0	1682	11.9	53.4	.604				
								SC	108.4	1736	12.8	62.4	.554				
								SC	116.5	1865	10.6	64.2	.446		***		
68	53	39	18	10	31	15	16	SC**	110.8	1774	11.0	57.0	.521		***		
								SC	105.3	1685	9.8	41.1	.600		***		
								SC	107.7	1725	10.9	52.0	.564				
								SC	101.4	1624	9.8	39.9	.662				
								SC	112.8	1807	10.2	55.8	.493				
								SC	101.9	1632	11.7	48.6	.653				
								CL	96.1	1539	7.3	26.1	.753				
								CL	101.4	1624	12.3	50.3	.661				
								CL	102.9	1649	13.6	57.3	.638				
								CL	104.9	1680	12.7	56.5	.606				
								CL	98.6	1579	15.1	57.7	.708				
								CL	106.4	1703	14.5	67.2	.583		***		
93	86	73	38	26	29	17	12	CL**	105.4	1687	13.8	62.3	.598		***		
								CL	103.9	1663	13.9	60.3	.622		***		
								CL	98.7	1581	13.2	50.3	.706				
								CL	102.4	1640	13.7	57.3	.646				
								CL	97.0	1554	11.6	42.7	.736				
								CL	99.4	1592	13.4	52.0	.695				

sification

tion based on lab tests

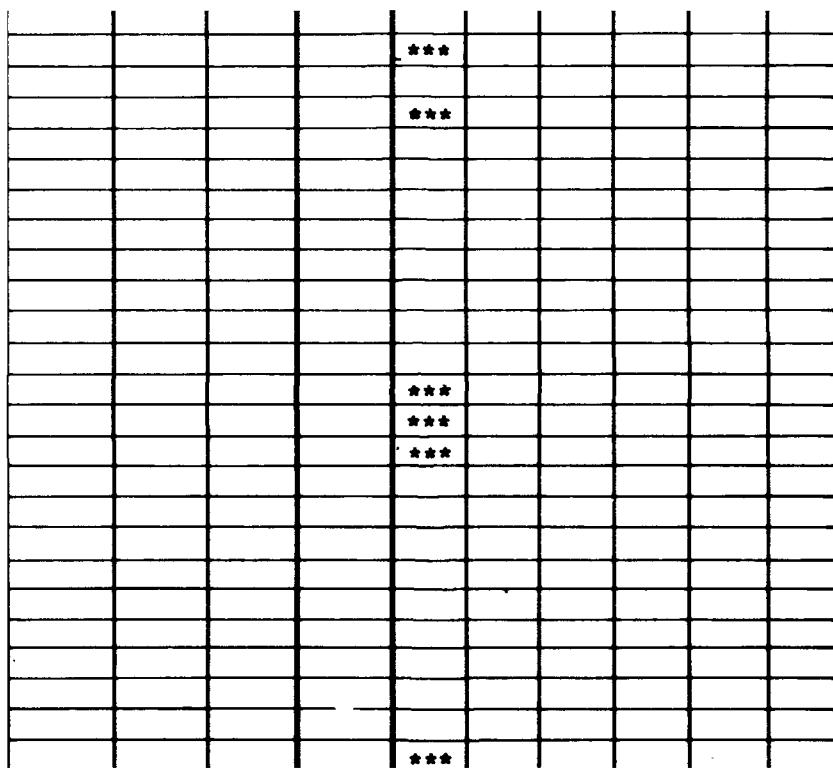
and results included in this report

SUMMARY

NAV TEST

MX S
DEPARTMENT

fuel



BORING NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL	PERCENT FINER BY WEIGHT										
			STANDARD SIEVE OPENING							U.S. STANDARD			
			BLDRS.	COBBLES	GRAVEL					4	10	40	
		FEET	METERS	24"	12"	6"	3"	1½"	¾"	¾"	4	10	40
M-14N	S-1	0.3-1.0	0.09-0.30										
		1.0-1.7	0.30-0.52										
		1.7-2.5	0.52-0.76										
	S-2	2.6-3.6	0.79-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52										
	S-3	5.0-5.7	1.52-1.74										
		5.7-6.4	1.74-1.95										
		6.4-7.6	1.95-2.32										
	S-4	7.6-8.3	2.32-2.53										
		8.3-9.0	2.53-2.74										
		9.0-10.1	2.74-3.08										
M-15S	S-1	0.3-1.0	0.09-0.30										
		1.0-1.7	0.30-0.52										
		1.7-2.5	0.52-0.76										
	S-2	2.6-3.6	0.79-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52										
	S-3	5.0-5.7	1.52-1.74										
		5.7-6.4	1.74-1.95										
		6.4-7.5	1.95-2.29										
	S-4	7.5-8.2	2.29-2.50										
		8.2-8.9	2.50-2.71										
		8.9-10.0	2.71-3.05										
M-16N	S-1	0.1-0.8	0.03-0.24										
		0.8-1.5	0.24-0.46										
		1.5-2.5	0.46-0.76										
	S-2	2.5-3.6	0.76-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52										
	S-3	5.0-5.7	1.52-1.74										
		5.7-6.4	1.74-1.95										
		6.4-7.5	1.95-2.29										
	S-4	7.5-8.2	2.29-2.50										
		8.2-8.9	2.50-2.71										
		8.9-10.0	2.71-3.05										
M-17S	S-1	0.1-0.8	0.03-0.24										
		0.8-1.5	0.24-0.46										
		1.5-2.5	0.46-0.76										
	S-2	2.5-3.6	0.76-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52										

NOTES:

(a). Sample types:

- S - Shelby Tube Sample
- P - Pitcher Barrel Sample
- D - Fugro Drive Sample

* Visual classif

** Classification

*** Test performed

INT							ATTERBERG LIMITS	USCS*	IN-SITU				COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL
	STANDARD SIEVE NO.		PARTICLE SIZE (mm)		SILT OR CLAY				DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY	OPTIMUM MOISTURE (%)		
	SAND	40	100	200	.005	.001	LL	PL	PI	(pcf)	(kg/m³)	(pcf)	(kg/m³)	(pcf)	(kg/m³)		
0	69	51	38	14	11	29	18	11	SC	98.4	1576	12.0	45.6	.712			
									SC	112.4	1800	10.6	57.5	.498			
									SC	108.2	1733	12.2	59.4	.556			
									SC	108.0	1730	11.1	53.6	.560			
									SC	108.3	1735	10.6	51.3	.556			
									SC	114.4	1833	11.1	63.5	.472		***	
									SC	119.9	1921	11.8	78.9	.405		***	
0	69	51	38	14	11	29	18	11	SC**	112.0	1794	12.3	66.1	.504			
									SC	108.8	1743	10.7	52.8	.548			
									SC	108.8	1743	9.6	47.4	.548			
									SC	105.5	1690	10.4	46.9	.597			
									SC	112.2	1797	11.8	63.6	.502			
									CL	97.3	1559	8.3	30.5	.731			
									CL	100.6	1611	11.5	46.1	.670			
									CL	103.9	1664	14.4	62.6	.621			
									CL	104.0	1666	15.5	67.5	.621			
									CL	105.2	1685	12.9	57.7	.602			
									CL	109.6	1754	14.5	72.9	.537			
08	94	86	72	33	12	29	16	13	CL**	103.6	1658	14.1	60.8	.626			
									CL	106.0	1697	14.2	65.1	.589			
									CL	100.1	1603	13.5	53.3	.683			
									CL	104.6	1676	12.3	54.4	.611			
									CL	91.4	1464	13.4	42.9	.844			
									CL	94.5	1514	13.0	45.0	.782			
									SC	103.9	1664	6.7	29.3	.621			
									SC	99.3	1591	13.8	53.3	.697			
									SC	112.9	1808	10.5	57.4	.492			
									SC	108.4	1736	13.4	65.5	.554			
									SC	115.2	1844	11.5	67.2	.463			
									SC	115.2	1844	11.8	68.8	.463			
37	69	55	41	20	16	30	16	14	SC**	114.5	1833	11.4	65.4	.471			
									SC	113.3	1815	11.0	61.1	.486			
									SC	114.8	1838	8.6	49.6	.468			
									SC	103.9	1664	10.4	45.4	.622			
									SC	104.8	1679	12.6	56.0	.608			
									CL	99.8	1599	12.8	50.4	.688			
									CL	98.9	1584	12.2	46.7	.702			
									CL	104.1	1668	13.1	57.1	.619			
									CL	103.0	1650	15.1	64.1	.636			
									CL	103.7	1661	14.3	61.7	.624			
									CL	104.8	1679	15.0	66.4	.608			

classification
cation based on lab tests
performed and results included in this report

SUM
MAY TEST
MX
DEPARTMENT
FUD

USCS*	IN-SITU				COMPACTED				SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	RELATIVE DENSITY							
	DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)														
	(pcf)	(kg/m³)				(pcf)	(kg/m³)															
SC	98.4	1576	12.0	45.6	.712																	
SC	112.4	1800	10.6	57.5	.498																	
SC	108.2	1733	12.2	59.4	.556																	
SC	108.0	1730	11.1	53.6	.560																	
SC	108.3	1735	10.6	51.3	.556																	
SC	114.4	1833	11.1	63.5	.472						***											
SC	119.9	1921	11.8	78.9	.405						***											
SC**	112.0	1794	12.3	66.1	.504						***											
SC	108.8	1743	10.7	52.8	.548																	
SC	108.8	1743	9.6	47.4	.548																	
SC	105.5	1690	10.4	46.9	.597																	
SC	112.2	1797	11.8	63.6	.502																	
CL	97.3	1559	8.3	30.5	.731																	
CL	100.6	1611	11.5	46.1	.670																	
CL	103.9	1664	14.4	62.6	.621																	
CL	104.0	1666	15.5	67.5	.621																	
CL	105.2	1685	12.9	57.7	.602																	
CL	109.6	1754	14.5	72.9	.537						***											
CL**	103.6	1658	14.1	60.8	.626						***											
CL	106.0	1697	14.2	65.1	.569						***											
CL	100.1	1603	13.5	53.3	.683						***											
CL	104.6	1676	12.3	54.4	.611																	
CL	91.4	1464	13.4	42.9	.844																	
CL	94.5	1514	13.0	45.0	.782																	
SC	103.9	1664	6.7	29.3	.621																	
SC	99.3	1591	13.8	53.3	.697																	
SC	112.9	1808	10.5	57.4	.492																	
SC	108.4	1736	13.4	65.5	.554																	
SC	115.2	1844	11.5	67.2	.463																	
SC	115.2	1844	11.8	68.8	.463						***											
SC**	114.5	1833	11.4	65.4	.471						***											
SC	113.3	1815	11.0	61.1	.486																	
SC	114.8	1838	8.6	49.6	.468						***											
SC	103.9	1664	10.4	45.4	.622																	
SC	104.8	1679	12.6	56.0	.608																	
CL	99.8	1599	12.8	50.4	.688																	
CL	98.9	1584	12.2	46.7	.702																	
CL	104.1	1668	13.1	57.1	.619																	
CL	103.0	1650	15.1	64.1	.636																	
CL	103.7	1661	14.3	61.7	.624																	
CL	104.8	1679	15.0	66.4	.608						***											

SUMMARY OF LABORATORY TEST RESULTS MARTIN MARIETTA GAS SITE MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA	TABLE 6 2 OF 3
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO	

FUGRO NATIONAL, INC.

BORING NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL	PERCENT FINER BY WEIGHT										
			STANDARD SIEVE OPENING						U. S. STANDARD				
			BLDRS	COBBLES	GRAVEL				4	10	40		
		FEET	METERS	24"	12"	6"	3"	1½"	¾"	⅜"	4	10	40
M-17S	S-3	5.0-5.7	1.52-1.74								100	99	95
		5.7-6.4	1.74-1.95										
		6.4-7.5	1.95-2.29										
	S-4	7.5-8.2	2.29-2.50										
		8.2-8.9	2.50-2.71										
		8.9-10.0	2.71-3.05										
M-17N	S-1	0.4-1.1	0.12-0.34										
		1.1-1.8	0.34-0.55										
		1.8-2.5	0.55-0.76										
	S-2	2.6-3.6	0.79-1.10										
		3.6-4.3	1.10-1.31										
		4.3-5.0	1.31-1.52										
	S-3	5.0-5.7	1.52-1.74										
		5.7-6.4	1.74-1.95								100	97	89
		6.4-7.5	1.95-2.29										
	S-4	7.6-8.3	2.32-2.53										
		8.3-9.0	2.53-2.74										
		9.0-10.0	2.74-3.05										
M-18	S-1	0.5-1.1	0.15-0.34										
		1.1-1.8	0.34-0.55										
		1.8-2.5	0.55-0.76								100	98	93
	S-2	2.5-3.2	0.76-0.98										
		3.2-3.9	0.98-1.19										
		3.9-4.5	1.19-1.37										

NOTES:

(a) Sample types:

- S - Shelby Tube Sample
- P - Pitcher Barrel Sample
- D - Fugro Drive Sample

* Visual classification

** Classification

*** Test performed

GHT						ATTERBERG LIMITS			IN-SITU				COMPACTED			TRIAXIAL				
STANDARD SIEVE NO.			PARTICLE SIZE (mm)						DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS			
SAND	SILT OR CLAY	(pcf)	(kg/m³)	(pcf)	(kg/m³)															
10	40	100	200	.005	.001	LL	PL	PI	CL**	107.6	1724	13.8	65.8	.566						
99	95	87	74	0	0				CL	101.4	1624	14.7	60.0	.662			2.70			
									CL	90.4	1448	15.1	47.1	.862						
									CL	106.1	1700	12.2	55.9	.588						
									CL	92.9	1488	15.0	49.8	.813						
									CL	106.5	1706	12.6	58.4	.582						
									SC	103.2	1653	7.5	32.2	.632						
									SC	108.4	1736	10.2	49.6	.554						
									SC	112.2	1797	12.0	64.9	.501						
									SC	108.0	1730	16.3	78.5	.560						
									SC	115.7	1853	12.8	75.7	.457						
									SC	114.0	1825	11.2	64.1	.478						
									SC	114.1	1826	11.7	61.6	.476						
89	70	54	40	18	15	29	17	12	SC**	111.6	1786	10.4	55.7	.509						
									SC	110.7	1773	11.8	61.0	.521						
									SC	104.9	1680	10.2	45.6	.607						
									SC	106.3	1703	10.7	49.3	.584						
									SC	104.1	1668	11.1	48.3	.618						
									CL	104.0	1666	9.3	40.5	.619						
									CL	110.6	1772	11.6	49.6	.524						
98	93	85	73	38	0	32	15	17	CL**	119.2	1909	12.2	79.7	.414						
									CL	114.0	1826	13.3	75.1	.479						
									CL	98.7	1581	14.1	53.8	.707						
									CL	105.6	1692	14.1	64.1	.596						

classification
ification based on lab tests
erformed and results included in this report



SUMMARY OF LABORATORY TEST RESULTS
MARTIN MARIETTA GAS SITE
MAV TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE
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30P 3

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE TEST	DRY DENSITY kg/m ³	MOISTURE CONTENT (%)	CONFINING PRESSURE (σ ₃) kN/m ²	MAXIMUM DEVIATOR STRESS (σ ₁ -σ ₃) kN/m ²	STRAIN RATE (%/min)	BACK PRESSURE kN/m ²
		FEET	METERS							
B-11	S-1-2	1.1-1.8	0.34-0.55	CL	106.5	1706	14.5	0.7	33.5	6.2
	S-1-3	1.8-2.5	0.55-0.76	CL**	CD	99.0	1586	14.1	2.9	138.9
	S-2-2	3.6-4.3	1.10-1.52	CL	96.4	1544	13.5	5.6	277.7	14.9
B-12N	S-2-3	4.3-5.0	1.31-1.52	CL**	CD	103.0	1649	10.5	0.7	33.5
	S-3-1	5.0-5.7	1.52-1.74	CL	CD	101.6	1627	10.5	2.9	138.9
	S-3-2	5.7-6.4	1.74-1.95	CL	CD	99.1	1587	13.1	5.6	277.7
B-12S	S-2-3	4.3-5.0	1.31-1.52	CL	CD	104.5	1674	14.4	0.7	33.5
	S-3-1	5.0-5.7	1.52-1.74	CL**	CD	103.2	1653	14.7	2.9	138.9
	S-3-2	5.7-6.4	1.74-1.95	CL	CD	103.9	1664	15.7	5.8	277.7
B-13N	S-2-3	4.3-5.0	1.31-1.52	CL	CD	101.9	1632	11.8	0.7	33.5
	S-3-1	5.0-5.7	1.52-1.74	CL	CD	109.0	1746	12.8	2.9	138.9
	S-3-2	5.7-6.4	1.74-1.95	CL**	CD	103.2	1653	13.8	5.8	277.7
B-14S	S-2-3	4.3-5.0	1.31-1.52	SC	CD	108.5	1738	14.9	0.7	33.5
	S-3-1	5.1-5.8	1.55-1.77	SC**	CD	105.0	1662	14.6	2.9	138.9
	S-3-2	5.8-6.5	1.77-1.98	SC	CD	106.0	1698	15.5	5.8	277.7
	S-3-3	6.5-7.5	1.98-2.28	SC	CD	111.8	1790	12.4	5.8	277.7
B-15N	S-2-3	4.3-5.0	1.31-1.52	CL	CD	110.8	1775	14.3	0.7	33.5
	S-3-1	5.0-5.7	1.52-1.74	CL**	CD	109.1	1748	13.5	2.9	138.9
	S-3-2	5.7-6.4	1.74-1.95	CL	CD	97.2	1557	13.5	5.8	277.7
B-17N	S-2-3	4.3-5.0	1.31-1.52	CL	CD	104.2	1669	13.8	0.7	33.5
	S-3-1	5.1-5.8	1.55-1.77	CL**	CD	113.5	1818	12.6	2.9	138.9
	S-3-2	5.8-6.5	1.77-1.98	CL	CD	108.9	1744	13.6	5.8	277.7

* Visual classification

** Classification based on lab tests

**SUMMARY OF TRIAXIAL COMPRESSION TESTS
BOEING GAS SITE
MAY SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO**

TABLE
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FUGRO NATIONAL, INC.

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	TYPE OF TEST	DRY DENSITY pcf	MOISTURE CONTENT (%)	CONFINING PRESSURE (σ_3) ksf	MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$) kn/m ²	STRAIN RATE (%/min)	BACK PRESSURE ksf
		FEET	METERS								
B-33	S-1-2	1.1-1.8	0.34-0.55	CL**	CD	103.8	1663	13.8	0.7	33.5	7.1
	S-1-3	1.8-2.5	0.55-0.76	CL	CD	95.0	1522	14.7	2.9	138.9	11.3
	S-2-2	3.4-4.1	1.04-1.25	SC	CD	95.1	1523	13.2	5.8	277.7	16.0
B-34N	P-3-3	4.8-5.5	1.46-1.68	CL	CD	99.9	1596	15.1	0.7	33.5	4.3
	S-4-1	5.7-6.4	1.74-1.95	CL**	CD	107.7	1724	12.5	2.9	138.9	10.6
	S-4-2	6.4-7.1	1.95-2.16	CL	CD	105.6	1690	13.1	5.8	277.7	14.0
B-34S	S-2-3	4.3-5.0	1.31-1.52	CL**	CD	115.2	1845	14.3	0.7	33.5	10.8
	S-3-3	6.5-7.5	1.98-2.29	CL	CD	92.2	1477	17.2	2.9	338.9	10.1
	S-3-2	5.8-6.5	1.77-1.98	CL	CD	99.2	1589	13.7	5.8	277.7	15.6
B-36W	S-2-3	4.3-5.0	1.31-1.52	CL	CD	113.6	1820	14.4	0.7	33.5	7.1
	S-3-1	5.1-5.8	1.55-1.77	CL	CD	113.1	1812	12.5	2.9	138.9	10.1
	S-3-2	5.8-6.5	1.77-1.98	CL**	CD	91.6	1563	12.1	5.8	277.7	15.8

* Visual classification

*** Classification based on lab tests

SUMMARY OF TRIAXIAL COMPRESSION TESTS
BOEING HYDRAULIC SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE
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FUGRO NATIONAL, INC.

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL	SOIL TYPE TEST	TYPE OF TEST	DRY DENSITY pc f	MOISTURE CONTENT (%)	CONFINING PRESSURE (σ ₃) kN/m ²	MAXIMUM DEVIATOR STRESS (σ ₁ -σ ₃) kN/m ²	STRAIN RATE (%/min)	BACK PRESSURE ksf	kN/m ²			
M-9	S-1-3	1.8-2.5	0.55-0.76	CL CD	98.2	1572	10.9	0.7	33.5	5.3	254	0.07	0	0
	S-2-1	2.5-3.2	0.76-0.98	CL CD	104.2	1668	13.5	2.9	138.9	13.4	642	0.07	0	0
	S-2-2	3.2-3.9	0.98-1.19	CL CD	104.1	1666	13.6	5.8	277.7	17.6	843	0.07	0	0
M-11S	S-2-2	3.6-4.3	1.10-1.52	CL CD	105.2	1685	14.0	0.7	33.5	7.1	340	0.07	0	0
	S-3-1	5.2-5.9	1.58-1.80	CL** CD	109.2	1749	13.8	2.9	138.9	15.0	718	0.07	0	0
	S-3-3	6.6-7.5	2.01-2.29	CL CD	97.1	1555	13.0	5.8	277.7	11.5	551	0.07	0	0
M-12N	S-2-3	4.3-5.0	1.31-1.52	SC CD	116.5	1865	10.6	0.7	33.5	5.8	282	0.07	0	0
	S-3-1	5.0-5.7	1.52-1.74	SC** CD	110.8	1774	11.0	2.9	138.9	10.5	503	0.07	0	0
	S-3-2	5.7-6.4	1.74-1.95	SC CD	105.3	1685	9.8	5.8	277.7	17.3	828	0.07	0	0
M-13S	S-2-3	4.3-5.0	1.31-1.52	CL** CD	106.4	1703	14.5	0.7	33.5	6.9	330	0.07	0	0
	S-3-1	5.0-5.7	1.52-1.74	CL CD	105.4	1687	13.8	2.9	138.9	11.0	527	0.07	0	0
	S-3-2	5.7-6.4	1.74-1.95	CL CD	103.9	1663	13.9	5.8	277.7	16.3	780	0.07	0	0
M-14N	S-2-3	4.3-5.0	1.31-1.52	SC CD	114.4	1833	11.1	0.7	33.5	5.4	239	0.07	0	0
	S-3-1	5.0-5.7	1.52-1.74	SC CD	119.9	1921	11.8	2.9	138.9	10.6	508	0.07	0	0
	S-3-2	5.7-6.4	1.74-1.95	SC** CD	112.0	1794	12.3	5.8	277.7	14.7	704	0.07	0	0
M-15S	S-2-3	4.3-5.0	1.31-1.52	CL** CD	109.6	1754	14.5	0.7	33.5	6.8	328	0.07	0	0
	S-3-1	5.0-5.7	1.52-1.74	CL CD	103.6	1658	14.1	2.9	138.9	11.3	541	0.07	0	0
	S-3-2	5.7-6.4	1.74-1.95	CL CD	106.0	1167	14.2	5.8	277.7	17.9	857	0.07	0	0
M-16N	S-2-3	4.3-5.0	1.31-1.52	CL** CD	115.2	1844	11.8	0.7	33.5	6.8	326	0.07	0	0
	S-3-1	5.0-5.7	1.52-1.74	CL CD	114.5	1833	11.4	2.9	138.9	12.0	575	0.07	0	0
	S-4-1	7.5-8.2	2.29-2.50	CL CD	114.8	1838	8.6	5.8	277.7	18.0	862	0.07	0	0

* Visual classification

** Classification based on lab tests

SUMMARY OF TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE
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FUGRO NATIONAL, INC.

SUMMARY OF TRIAXIAL COMPRESSION TESTS
MARTIN MARIETTA GAS SITE
MAY TEST SITE, SAN CRISTOBAL VALLEY, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSON

TABLE
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UGRO NATIONAL, INC.